

EXHIBIT 1

(PART 1 OF 3)

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UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

IN RE: CATHODE RAY TUBE (CRT))	Master File No. CV-07-5944 SC
ANTITRUST LITIGATION)	
)	MDL No. 1917
)	
)	EXPERT REPORT OF JANET S. NETZ,
)	PH.D
)	
<hr/>)	
This document relates to:)	
)	
ALL INDIRECT PURCHASER ACTIONS)	The Honorable Samuel Conti
<hr/>)	

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I. Qualifications

I, Janet S. Netz, am a founding partner of applEcon, LLC. I have been a tenured Associate Professor of Economics at Purdue University and a Visiting Associate Professor at the University of Michigan. I received a B.A. (1986) from the University of California, Berkeley, *cum laude*, and an M.A. (1990) and Ph.D. (1992) from the University of Michigan, all in the field of economics. My doctoral fields were Industrial Organization, which is the study of firms and markets, the economic field most closely related to the issues in this case specifically and in antitrust generally, and International Trade, which includes the study of firms and markets in a global environment.

Among the courses that I have taught, those that are most closely related to the issues of this case include Industrial Organization at the undergraduate and doctoral level; Antitrust and Regulation at the undergraduate level; Microeconomic Theory at the undergraduate and master's level; and International Trade at the undergraduate and master's levels. I have guest lectured on the role of an economic expert in an Alternative Dispute Resolution class at the University of Michigan Law School. I have spoken on the role of economists and economics in class action antitrust cases at several American Bar Association conference programs. My research has focused on competitive interactions of firms and strategies firms can use to increase profits. I have published in peer-reviewed, scholarly journals and have presented my research at many conferences and seminars. A detailed account of my academic employment and publication histories is provided in my curriculum vitae, which is attached as Exhibit A.

I have testified in trial or by affidavit or declaration, especially with regard to the determination of the impact of anti-competitive conduct on consumers and quantifying the magnitude of the impact, for over ten years. In addition, I have consulted on numerous antitrust cases. I provide a list of the cases on which I have testified and consulted in my curriculum vitae, which is attached as Exhibit A.

I am compensated for my work on this case at the rate of \$450 per hour. My compensation is not dependent on my opinions or the outcome of the case.

II. Summary of Plaintiffs' claims

A. Definition of class and sub-classes

The Plaintiffs allege that the price-fixing conspiracy extends from at least 1 March 1995 through 25 November 2007. The State-Wide Classes are defined as:

All persons and entities in [Indirect-Purchaser State] who, from March 1, 1995 to November 25, 2007, as residents of [Indirect-Purchaser State], purchased Cathode Ray Tubes incorporated in televisions and monitors in [Indirect-Purchaser State] indirectly from any defendant or subsidiary thereof, or any named affiliate or any named co-conspirator, for their own use and not for resale. Specifically excluded from this Class are defendants; the officers, directors, or employees of any defendant; the parent companies and subsidiaries of any defendant; the legal representatives and heirs or assigns of any defendant; and the named affiliates and co-conspirators. Also excluded are any federal, state, or local

governmental entities, any judicial officers presiding over this action, members of their immediate families and judicial staffs, and any juror assigned to this action.¹

The indirect purchaser states include: Arizona, California, District of Columbia, Florida, Hawaii, Iowa, Kansas, Maine, Michigan, Minnesota, Mississippi, Nebraska, Nevada, New Mexico, New York, North Carolina, North Dakota, South Dakota, Tennessee, Vermont, West Virginia, and Wisconsin. The applicable class period for Hawaii, Nebraska, and Nevada begins from June 25, 2002, July 20, 2002, and February 4, 1999, respectively.²

CRT products are defined as color display tubes (CDTs) which are used in computer monitors and color picture tubes (CPTs) which are used in TVs. CRT products also include the finished TVs and computer monitors containing CPTs and CDTs, respectively.³

The economic analysis that I describe below applies to the state classes. Unless expressed otherwise or the context clearly indicates otherwise, I will refer to the class or class members, meaning all Indirect Purchaser State Classes.

B. Membership of the cartel

The CRT cartel was comprised of: fourteen Defendants (BMCC, Chunghwa, Daewoo/Orion, Hitachi, IRICO, LG Electronics, LPD, Matsushita, MTPD, Philips, Samsung, Samtel, Thai CRT, and Toshiba; Daewoo/Orion, LPD, and Thai CRT no longer exist) and three companies that Plaintiffs have named as Co-Conspirators and with whom Plaintiffs have entered into a tolling agreement (Thomson, Mitsubishi, and Videocon).⁴

C. Cartelization of the CRT industry

At least as early as 1995, Defendants began colluding in an effort to raise CRT prices and profits above the competitive level. The conspiracy encompassed both CPTs and CDTs, and lasted at least twelve years, including the years during which CRT demand declined due to the advent of LCD (liquid crystal display) technology.

¹ 20 June 2013, Report and Recommendation Regarding Indirect Purchaser Plaintiffs' Motion for Class Certification, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division), at 40-47 (listing statewide damages classes); 24 September 2013, Order Adopting Special Master's Reports and Recommendations on Defendants' Motion to Exclude Expert Testimony and Indirect-Purchaser Plaintiffs' Motion for Class Certification, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).

² 01 October 2012, Memorandum of Points and Authorities in Support of Motion of Indirect-Purchaser Plaintiffs for Class Certification, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division) (Hereinafter "IPPs Memo in Support of Class Cert."), at 2.

³ This excludes certain products that are CRT-based but not in the case (i.e., rear projection products). 10 January 2013, Indirect Purchaser Plaintiffs' Fourth Consolidated Amended Complaint, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco) (Hereinafter "Complaint").

⁴ Complaint, at ¶¶ 50-115.

During the twelve years of the conspiracy,⁵ a cartel monopolized the manufacture of CRTs. The cartel's membership included most of the largest CRT manufacturers. Monopolization of CRTs was effected by a variety of mechanisms, including: the cartel meeting to fix prices and to restrict production and capacity, with top management in regular attendance. In addition, the CRT cartel fixed market shares among cartel members; allocated customers to cartel members; shared information, such as capacity and output, not ordinarily shared with competitors; and created opportunities for managers of "competing" companies to build trust through socialization.⁶

The cartel set up multilateral meetings of representatives of cartel members it called "Glass Meetings", and established three other types of meetings, "Top Meetings" attended by top executives such as vice presidents and chief operating officers of cartel members; "Management Meetings"; and "Working-Level Meetings".⁷ The latter two types of meetings were generally held monthly, and at times as frequently as weekly.⁸ In addition, "Green Meetings" were planned on golf courses to follow Glass Meetings "in order to make friendly contacts and strengthen mutual trust".⁹

Defendants have produced documents related to Glass Meetings, such as meeting notes taken by representatives of member firms, and documents that appear to have been used at meetings of the cartel, such as meeting agendas and slide presentations. To date, I have found documents related to over 130 meetings at which the cartel members discussed and agreed to prices they would

⁵ The CRT cartel's operations spanned the years 1995 through 2007. The class period begins at least as early as March 1, 1995 and ends no earlier than November 25, 2007. Complaint, at 1.

⁶ Complaint.

⁷ Complaint, ¶¶ 147-150. Section VIII.A.3.a).

⁸ See, e.g.,

- Notes of a meeting between Samsung, Philips, LG Orion and CPT state: "CPT suggested that weekly meeting shall be called to review price increase status, all makers agreed and set a Meeting at CPT Yang MEI factory on 3/27/97 at 9:30 AM, and setup the following dates for future meetings as follows for the time being: 4/2: PH Taipei, 4/9: LG, 4/16: Daewoo 4/23: SDD In order to strengthen communication, ensure price increases to succeed smoothly." Chunghwa Picture Tubes, LTD, 19 March 1997, Customer Contact Report, CHU00028752 - CHU00028754, at 8753.01E (emphasis supplied).
- "Review of the implementation method of the Working Level weekly meeting: Each maker indicated that because of the success of Glass Meeting, everybody has been Enjoying Business this year. Now that the Slow Season is coming, everybody should continue to strengthen communications and contacts, so the weekly meetings should continue to be held on time." Chunghwa Picture Tubes, LTD, 09 November 1999, Visitation Report, CHU00030916 - CHU00030918, at 0916.02E (emphasis supplied).

⁹ See, e.g.,

- "[I]n order to make friendly contacts and strengthen mutual trust, the makers agreed that every 3-4 weeks they would take turns to host a Green Meeting (only two members from each maker) after the meeting is over." Chunghwa Picture Tubes, LTD, 09 November 1999, Visitation Report, CHU00030916 - CHU00030918, at 0916.02E.
- A Green Meeting was held at Country Height Golf Resort on 6 March 1999. Report (Submitted), CHU00021268 - CHU00021276, at 1268.01E.
- A Green Meeting was held at Palm Garden Golf Club on 24 February 2005. Chunghwa Picture Tubes, LTD, 24 February 2005, CHU00661917, CHU00661917 - CHU00661928, at 1917.

charge for CRTs; see Exhibit 1 for a list of cartel documents that evidence cartel meetings at which prices were fixed or confirmed.

The CRT cartel also colluded to divide the CRT market, by a variety of means. The simplest division of the market was an agreement regarding shares of the overall CRT market among cartel members. The cartel also reached agreements by which cartel members were given a share of a particular customer's business, or an exclusive right to certain large customers. Some cartel members were implicitly awarded a larger share of certain large customers. They were authorized to charge a lower price to that customer than the price allowed to be charged by other suppliers. I give a fuller accounting of the conduct of the CRT cartel below, in Section VIII.A.3.

III. Competition agencies investigated and fined cartel members

Chunghwa began cooperating with competition authorities in several countries in early 2007 and competition authorities raided CRT manufacturers in November 2007.¹⁰ Numerous criminal and civil complaints followed both in the United States and abroad.

In the United States, the Department of Justice (DOJ) has, to date, indicted six former executives for participation in the CRT cartel.¹¹ In March 2011, Samsung SDI agreed to plead guilty and pay a \$32 million fine to the DOJ for its participation in the CRT cartel.¹²

The European Commission (EC), Korean Fair Trade Commission (KFTC) and Japanese Fair Trade Commission (JFTC) all concluded that cartel members colluded to fix prices, restrict output and allocate customers.¹³ The EC levied fines totaling €1.47 billion (\$1.92 billion), the KFTC levied fines of ₩26.3 billion (\$23 million), and the JFTC fined cartel members ¥3.3 billion (\$37 million). The latter was notable in that it represented the first time the JFTC had fined foreign-based firms for violations of Japanese competition law.¹⁴

IV. My assignment

¹⁰ European Commission, 19 October 2013, Final Report of the Hearing Officer TV and Computer Monitor Tubes, Official Journal of the European Union.

¹¹ United States Department of Justice, 09 November 2010, Three Former Executives Indicted in Color Display Tube Price-Fixing Conspiracy, http://www.justice.gov/atr/public/press_releases/2010/264069.htm, accessed 18 November 2013.

¹² United States Department of Justice, 18 March 2011, Samsung SDI Agrees to Plead Guilty in Color Display Tube Price-Fixing Conspiracy, http://www.justice.gov/atr/public/press_releases/2011/268592.htm, accessed 18 November 2013.

¹³ See, e.g.,

- European Commission, 05 December 2012, Antitrust: Commission fines producers of TV and computer monitor tubes €1.47 billion for two decade long cartels, Official Journal of the European Union.
- Korean Fair Trade Commission, 10 March 2011, Multi-party Meeting, 2010Gukka234, Decision no. 2011-019.
- McKenzie, Liz, 07 October 2009, JFTC Slams Samsung, MT Picture In CRT Cartel Probe, Law360, http://competition.law360.com/print_article/126904, accessed 08 October 2009.

¹⁴ See, e.g.,

- McKenzie, Liz, 07 October 2009, JFTC Slams Samsung, MT Picture In CRT Cartel Probe, Law360, http://competition.law360.com/print_article/126904, accessed 08 October 2009.

I was asked by Plaintiffs' counsel to evaluate the impact of the alleged cartel and to quantify the magnitude of the harm, if any, to class members. There is no question that Defendants engaged in many types of prohibited collusive conduct including sharing competitively sensitive information, setting target prices, and restricting output. The economic questions I addressed in my economic analysis of the cartel's impact include:

1. Were the characteristics of the industry and cartel suitable to allowing a cartel to increase price above the competitive level?
2. Were the actions of the cartel successful at raising prices to direct purchasers?
3. Would at least some portion of any overcharge to direct purchasers be passed through to class members who purchased CRT monitors and TVs for personal use?
4. What is an economically reasonable estimate of the overcharge imposed by cartel members on direct purchasers?
5. What is an economically reasonable estimate of the pass-through rate of any overcharge to class members?
6. Given economically reasonable estimates of the overcharge and pass-through, what is the harm imposed on class members?

To perform these analyses and calculations, my staff, under my guidance, and I reviewed numerous materials on which I based my conclusions. This material includes documents and data produced in the discovery process of the case, as well as publicly available documents relating to the CRT industry. The latter includes, but is not limited to, company SEC filings, Annual Reports, press releases, CRT and display industry reports, news and journal articles, white papers and presentations from research firms, and CRT-related websites.

To the best of my ability, I kept track of the materials reviewed. In Exhibits B and C, I provide a list of all confidential and public documents, respectively, that my staff and I have reviewed to date. I reserve the right to revise my conclusions and opinions as more information comes to light.

V. Summary of my conclusions

I investigated the economic characteristics of CRTs, CRT manufacturing, CRT industry structure, firms that manufacture CRTs, and how CRTs are distributed from CRT manufacturers to class members (end users). I found that CRTs have a small number of product characteristics that are economically significant and that manufacturing is subject to barriers to entry. In addition, I found that the CRT industry was a so-called "sick industry"; that is, there was falling demand and excess capacity throughout the damages period. While the manufacture of CRTs was subject to collusion, the manufacture, distribution, and sales of CRT monitors and TVs were highly competitive. I describe the analyses and facts that support my conclusions in Section VI.

I conclude that the following findings from the economic study of cartels are relevant to the analysis of whether the CRT cartel was effective in raising price above the competitive level and quantifying that impact:

- A cartel can be effective even if the price charged by the cartel declines over time by reducing the magnitude of the price decline and/or by reducing the speed of the price decline.

- Cartel success is a matter of degree. So long as the cartel is able to raise price above the competitive level, the cartel is successful, even if it is not able to set price equal to the monopoly level. Similarly, a cartel can increase price above the competitive level even in the presence of some degree of cheating.
- A cartel that is made up of vertically integrated and unintegrated firms can successfully increase price above the competitive level.

I briefly describe these conclusions in Section VII and I explain why these conclusions hold in Appendix 1.

I next examined whether the CRT cartel had the market power necessary to raise the price of CRTs above the competitive level. I find that neither entry from other CRT manufacturers nor the development of LCD display technology prevented the cartel from exercising market power. I describe the analyses and factual foundation for my conclusion in Section VIII.A.2. I then investigated the mechanisms used by the cartel. These included extensive and frequent face-to-face meetings, phone calls, and electronic communications; plans to reduce production and capacity; methods to monitor whether cartel members were abiding by agreements; and allocating customers. I conclude that the result of these actions, described in Section VIII.A.3, was to increase the price of CRTs above the competitive level. I then looked for direct evidence that CRT prices were above the competitive level. Documentary evidence, as described in Section VIII.A.1, showed that the cartel and members themselves proclaimed their success. Finally, I undertook regression analyses of the prices charged to determine whether they were determined by the target prices set by the cartel members. The results from the regression analyses, described in Sections VIII.A.4.a) and VIII.A.4.b), confirm my conclusion that the cartel was successful in raising price above the competitive level.

I investigated whether price changes in the price of CRTs were passed through to class members (end users) via the prices of CRT monitors and TVs. The implication of economic theory is clear: a price increase that is not insignificant, non-transitory, and industry-wide is passed on to the next level in the chain of distribution. Pass-through is also a matter of degree; class members are harmed as long as any portion of the overcharge is passed down the distribution chain. An examination of the documentary and testimonial evidence and the facts of the industry and case further support my conclusion that class members were harmed as a result of the cartel's actions. I describe the analysis of pass-through in Section VIII.B.

I then turn to tools that allow me to quantify the degree of harm Defendants imposed on class members. I proceed by first estimating the overcharge imposed by cartel members on direct purchasers; then estimating the portion of the overcharge that was passed through to class members; and finally using the overcharge and pass-through rates in conjunction with expenditures by class members on CRTs to calculate the total damage suffered by the class as a result of the increased price. As described in Section IX, I conclude, on the basis of my examination of the data, that CRTs (the CRTs used to make monitors) were overcharged at the rate of 25.0% for 1995Q2-2006Q4 and 12.3% for 2007Q1 to 2007Q4 and CPTs (the CRTs used to make TVs) were overcharged at the rate of 9.5% and 3.2%. I conclude that at least 100% of the overcharge was passed through to class members, based on the evidence presented in Section X. Finally, I calculate that the damages borne by class members who purchased CRT monitors was \$2.296 billion and CRT TVs was \$780 million, for a total of \$3.076 billion.

VI. The CRT industry

In order to perform a proper economic damages analysis, I first consider the relevant economic nature of CRTs, CRT manufacturing, and the CRT industry. A factual understanding of CRTs and the CRT industry leads to the conclusion that, absent the cartel, the industry could have been expected to be quite competitive, possibly ruinously so.

The cathode ray tube (CRT) is a mature display technology widely used in televisions and computer monitors in the late-1990s and the first decade of the 21st century. CRTs operate by shining an electron beam onto a phosphor-coated panel, causing the phosphors to glow, emitting red, green, and blue light to compose a picture. The CRTs relevant to the present case range in size from 14" to 42".

A. CRT product description

1. The basic components of CRTs

CRTs operate by shining a beam of electrons on a screen that is coated with material that glows when the electron beam strikes it. The primary components of a CRT are a large glass bulb containing an electron gun and a pair of devices near the rear of the bulb that focus and aim the electron beam. The bulb is comprised of two elements. The front of the bulb is called the panel; this is the screen the viewer observes. It is coated on the inside with phosphors that glow when the electron beam strikes them, emitting red, green, or blue light. The remainder of the bulb is called the funnel, because of its funnel shape. The electron gun is housed inside the neck of the funnel. Around the outside of the neck are the convergence purity magnets (CPM) and the deflection yoke. The CPM focuses the electron beam. The deflection yoke, sometimes called a deflection coil, aims the electron beam. It scans the electron beam back and forth and up and down across the screen.¹⁵ The CRT creates a picture by turning the electron gun on and off as the deflection yoke moves the beam across the screen, thereby exciting (illuminating) the appropriate color phosphors in the proper locations to create the full color picture. The mask is an additional component inside the bulb, very close to the inside surface of the panel. Its purpose is to absorb stray electrons to ensure that electrons strike only the phosphors that are supposed to be illuminated.

2. CRTs have a small number of economically significant dimensions of product differentiation

CRTs are differentiated products. The primary dimensions of differentiation are the application, size, shape, and finish. Additional differentiation comes from different resolutions and the use of various coatings and mask type, but these differences have a much smaller effect on price differences than do differences across the primary dimensions of differentiation.

CRTs are sold primarily for use in two distinct applications: computer monitors and TVs. CRTs sold for use in monitors are called "color display tubes", or CDTs;¹⁶ CRTs sold for use in televisions are called "color picture tubes", or CPTs. While the basic technologies of the two

¹⁵ For a nice cutaway showing the main components of a CRT, see Engelsen, Daniel den, 15 June 2000, Manufacturing of CRTs 1, SDCRT-020298, at 4.

¹⁶ Philips, and possibly some other firms, at times also refer to these as CMTs (computer monitor tubes). Philips, 12 April 1999, Strategy Review 1999-2003 Region North America, PHLP-CRT-088450, at 86.

tubes are similar, there are differences between them.¹⁷ The two types of tubes are not functional or economic substitutes: a TV manufacturer could not and would not use a CDT and a monitor manufacturer could not and would not use a CPT.¹⁸

The second major type of differentiation is the size of the tubes. The size of the tube is typically measured diagonally across the screen, in either inches or centimeters.¹⁹ The most common CDT

¹⁷ See, e.g.,

- CPTs are designed for high brightness while high resolution is more important for CDTs. Different mask and phosphor structures are used for the two types of tubes. SDI, Undated, Model of SDI CRT Product, SDCRT-0021278 - SDCRT-0021294, at 1288-1289.
- CPTs generally use striped phosphors and aperture grilles or slotted masks, while CDTs use dot phosphors and hexagonal arrangement of openings in the mask. Engelsens, Daniel den, 15 June 2000, Manufacturing of CRTs 1, SDCRT-0202981, at 6 and 12.
- The dot pitch (resolution) of CDTs and CPTs are “totally different”. 03 July 2012, Deposition of Hitachi Electronic Devices (USA) 30(b)(6) Witness Thomas Heiser (Hereinafter “Hitachi 30(b)(6) Deposition of Thomas Heiser, 03 July 2012”), at 59:16-24.
- The holes in CPT masks were generally stripes while CDTs had small dots to give higher resolution. 09 July 2012, Deposition of LG Electronics 30(b)(6) Witness Mok Hyeon Seong (Hereinafter “LGE 30(b)(6) Deposition of Mok Hyeon Seong, 09 July 2012”), at 97:13-98:2.

¹⁸ See, e.g.,

- CPTs lack the resolution to be used in monitors; CDTs cannot handle the power required in a television. 16 July 2012, Deposition of Panasonic Corporation, Panasonic North America and MTPD 30(b)(6) Witness Tatsuo Tobinaga (Hereinafter “Panasonic 30(b)(6) Deposition of Tatsuo Tobinaga, 16 July 2012”), at 142:19-143:23.
- CPTs and CDTs have different masks. SDI, Undated, Model of SDI CRT Product, SDCRT-0021278 - SDCRT-0021294, at 1288.
- From Nobuhiko Kobayashi’s Deposition: “Q. And when you talked about the differences among the shadow masks and resolution, did that testimony apply equally to CDTs as CPTs? A CPTs and CDTs are entirely different.” 17 July 2012, Deposition of Hitachi Displays, Ltd. 30(b)(6) Witness Nobuhiko Kobayashi, Volume I (Hereinafter “Hitachi 30(b)(6) Deposition of Nobuhiko Kobayashi, Vol. I, 17 July 2012”), at 38:6 - 9.

¹⁹ Generally, the sizes discussed are the size of the CRT itself. However, manufacturers also referenced tubes by their viewable area, e.g. 25-V or 25V. 31 July 2012, Deposition of Philips Electronics North America Corporation, Inc. and Koninklijke Philips Electronics N.V. 30(b)(6) Witness Roger De Moor (Hereinafter “Philips 30(b)(6) Deposition of Roger De Moor, 31 July 2012”), at 46:11-47:9.

sizes ranged from 14" to 21" during the damages period.²⁰ Most CPTs were between 14" and 34" during the damages period.²¹

The aspect ratio, which is the relationship between the width and height of the screen, is another type of differentiation. For most of the damages period, CRTs used a 4:3 aspect ratio. In the latter part of the damages period, "widescreen" CRTs started being made. These had an aspect ratio of 16:9.²² Widescreen CPTs differ from traditional CPTs in more than just the aspect ratio: widescreen CPTs have both higher resolution and scanning frequencies than traditional CPTs.²³

The flatness of the panel, which I refer to as the "shape", is another dimension of differentiation. The front panel of a CRT was traditionally a portion of a sphere. Over time, manufacturers increased the radius of curvature of the screens in order to make the screens flatter.²⁴ Eventually manufacturers were able to produce truly flat CRTs. These went by various names, including – pure flat, real flat, and Dynafat.²⁵

²⁰ CDTs smaller than 14" are not observed in worldwide data from 1996-2006. CDTs larger than 21" are not observed in worldwide data from 1996-2000, and observations from 2005 – 2006 show that 21"+ CDTs comprise small shares of overall CDT production. See, e.g.,

- Samsung, 11 December 2003, Worldwide CDT Manufacturer's Status, SDCRT-0201291.
- DisplaySearch, 30 September 2005, Q3'05 Quarterly Desktop Monitor Shipment and Forecast Report, CHU00281352 - CHU00281923, at 1644.
- DisplaySearch, 30 March 2007, Q1'07 Quarterly Desktop Monitor Shipment and Forecast Report, CHU00154037 - CHU00154420, at 4389.

²¹ CPTs smaller than 14" and larger than 34" comprise a small portion of worldwide CPT production from 2000 – 2006. MT Picture Display, November 2006, Untitled Spreadsheet, MTPD-0416090.

²² Michael Milostan, Senior Manager of Toshiba America's technical staff in 2000, talking about wide screens before the International Trade Commission: "the SDTV [standard definition television; digital TV standards that essentially replicated the old analog standards] format is designed for the four by three aspect ratio. By comparison, wide-screen CPTs with the 16 by nine aspect ratio which are optimal types of CPT for HDTV [high definition television] broadcasts...And whether the standard becomes SDTV or HDTV is anything but certain. It would be a long time before the market sorts out the choices. In the meantime, conventional CPTs with four by three aspect ratios will remain the workhorse of the industry." United States International Trade Commission, 17 February 2000, United States International Trade Commission In the Matter of: Color Picture Tubes from Canada, Japan, Korea, and Singapore, SDCRT-0068880 - SDCRT-0069081, at 9015.

²³ The scanning frequency of a CRT describes the frequency at which the screen is repainted. "at the consumer electronics show that was held in Las Vegas just last month every and each Japanese Korean company [sic] heavily promoted and demonstrated 16-by-9 CRTs as the immediate answer for high-definition, digital TV in the market today." United States International Trade Commission, 17 February 2000, United States International Trade Commission In the Matter of: Color Picture Tubes from Canada, Japan, Korea, and Singapore, SDCRT-0068880 - SDCRT-0069081, at 8906.

²⁴ These tubes went by various names. Some specified the "flatness" in terms of a multiplier of 'R' – 1.0R, 1.3R, 1.5R, 1.7R, 2.0R – all referencing an increasing radius of curvature, and hence flatter, but still curved, screen. SDI, Undated, Model of SDI CRT Product, SDCRT-0021278 - SDCRT-0021294, at 1278. These were also described as "flat square" or "square flat" tubes because the tube corners were closer to square and the panel was closer to flat than older styles. 2000, The Different Types of CRT Monitors: From ShortNeck to FST [ca. 2000], PC Tech Guide, <http://www.pctechguide.com/crt-monitors/the-different-types-of-crt-monitors-from-shortneck-to-fst>, accessed 13 March 2012 at 2. MTPD ascribed "FS" (flat square) to 1.3R and 1.7R tubes. MT Picture Display, 20 January 2005, MTPD FY2005-06 Business Plan, MTPD-0401227, at tab 'Product Lineup', Rows 45 & 47.

²⁵ See, e.g.,

Another type of differentiation across CRTs is the degree to which the CRT assembly is completed by the tube manufacturer, in particular with regard to whether or not the product shipped with a deflection yoke. When a CRT is shipped without a deflection yoke, it is called a “bare” CRT. A CRT with a deflection yoke is called an “integrated tube component” (ITC) CRT.²⁶

I am aware of other variations among CRTs that the cartel members at times addressed in their discussions of tube pricing. For example, the shadow mask can be made of different materials, with Invar and aluminum killed steel (AK) being the two most frequently discussed.²⁷ For CDTs, resolution, indicated by the “dot pitch” (the distance between dots of the same color), was another type of differentiation.²⁸ Lastly, there are also different safety and performance standards for monitors that can affect the price.²⁹ As I demonstrated in my Class Certification Rebuttal Report, the price differences resulting from these product differences were relatively insignificant.³⁰

The result of having a limited range of economically meaningful dimensions for product differentiation is that industry sales were heavily concentrated on a relatively small number of product families from each vendor.³¹

3. CRT manufacturers engage in design-in competition

In addition to the types of product differentiation just described, there are other differentiating factors among CRTs. While the factors just described generally resulted in differentiation of monitors and TVs, as valued by consumers, there are other attributes – e.g., subtle differences in the curvature of the tube where it meets the bezel of the TV or different electrical requirements – that are important to finished product manufacturers but not to end customers.

Due to the technical product differentiation that is necessary to the incorporation of tubes into monitors and TVs, competition among CRT vendors is for design-in, not each individual CRT

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- Pure flat is truly flat. Panasonic, Undated, Panasonic Display Development Plan, MTPD-0570911, at 1.
 - Dynafat has a flat screen surface and a curved inner surface. Flatron has a perfectly flat screen surface and inner surface. Also, real flat indicates that the screen has flat screen surface. LG, Undated, Why Flatron?, LGE00060914, at 4-5.

²⁶ Hitachi 30(b)(6) Deposition of Thomas Heiser, 03 July 2012, at 44:4-20.

²⁷ Invar is high-nickel-content steel. AK steel is manufactured using aluminum powder in the foundry process to remove impurities from the steel. Invar resists deformation from heat (which is generated by electrons striking the mask) better than AK steel. SDI, Undated, Model of SDI CRT Product, SDCRT-0021278 - SDCRT-0021294, at 1279.

²⁸ 2012, What is the Dot Pitch of a Computer Monitor, PC Tech Guide, <http://www.pctechguide.com/crt-monitors/what-is-the-dot-pitch-of-a-computer-monitor>, accessed 13 March 2012.

²⁹ TCO and MPRII, frequently referenced in meeting note discussions about CDT prices, are safety standards promulgated by Sweden. PCTechGuide.Com, Undated, TCO Monitor Standards, <http://www.pctechguide.com/crt-monitors/tco-monitor-standards>, accessed 03 August 2012, at 0115.

³⁰ Netz, Janet S., 15 February 2013, Rebuttal Declaration of Janet S. Netz, Ph.D., in Support of Motion of Indirect-Purchaser Plaintiffs for Class Certification, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division) (Hereinafter “Netz Rebuttal”), at 12.

³¹ Netz Rebuttal, at 10-12.

order. That is, when a TV or monitor manufacturer develops a new model, the CRT vendors compete to win the design.³² Absent coordination among the bidders, competition for design wins could be fierce, with price being a major factor. Once a TV or monitor manufacturer has chosen a specific CRT as the basis for a given model of TV or monitor, it cannot readily substitute a different vendor's CRT into the finished product.³³ If the product maker wanted to switch to a different CRT from the same or another tube manufacturer, the TV or monitor manufacturer would instead design and produce an alternative monitor or TV model using a different vendor's tube.³⁴

A CRT manufacturer might compete for a design win with an existing tube design, a variation of an existing design, or a completely new design. The concentration of each manufacturer's production in a very small range of models suggests manufacturers used existing designs for most design-in competitions.³⁵

Despite the fact that a TV or monitor manufacturer cannot readily change the CRT used in a given design, they are not "locked-in" to a given CRT manufacturer's product. The TV or monitor manufacturer can substitute manufacturer A's CRT for manufacturer B's CRT by reducing production of the product using CRT B and increasing production of the product using CRT A. Thus, absent the cartel, TV and monitor manufacturers benefit from CRT competition at both the design stage and the production stage.

B. The economics of CRT manufacturing

CRT production occurs as a sequential process on a production line. Most CRT production lines are dedicated to producing a limited range of CRT products. Production lines can generally be modified to produce new products, with the difficulty of the modifications depending on how closely related the new product is to the existing capabilities of the line.

CRTs are produced in large factories. While most factories tend to have multiple production lines, there were several that had only one. CRT factories are typically capable of producing

³² "Q. Okay. And how would the customer articulate its needs to HED/US? A. There was a whole design process that went on before a picture tube was ever sold. You'd have probably a six months to one year, depending upon the customer, that would be a design cycle where we knew they were coming out with a new television set, and our engineer, our sales engineer would begin to work with them on the specification, what they wanted, what kind of performance, what kind of pinning specification, for example, how fine did they want it Pinned, what would they allow for convergence, or for – there were various other specifications you'd use on how the yoke was going to perform. Trapezoidal. There was many different parts of it, and those would all be called out in that design specification." Hitachi 30(b)(6) Deposition of Thomas Heiser, 03 July 2012, at 69:2-17.

³³ This is because of significant differences across CRTs that, unlike the size, shape, and other differences described earlier in the text, are not manifested in the appearance of the tube. For example, different tubes use different electron guns and deflection yokes, giving tubes from different vendors unique electrical requirements, and the shape of the outer edges of the screen are different across different tubes, requiring different faceplate or bezel shapes to mate with them.

³⁴ "Generally what would have to happen is customers would either have to do custom design around our specific tube type because our mechanics were different. So, or if they decided to try to so-called dual source, they needed to have two separate types of chassis due to the mechanical, some of the electrical differences of our product." 31 July 2012, Deposition of Toshiba America Electronics Corporation 30(b)(6) Witness Jay Alan Heinecke (Hereinafter "TAEC 30(b)(6) Deposition of Jay Alan Heinecke, 31 July 2012"), at 38:8-39:2.

³⁵ For evidence showing the concentration of each manufacturer's CRT output in a few product families, see Netz Rebuttal report, at 10-12.

between 100,000 and 1 million CRTs per month, with the largest factories able to produce over 1.5 million CRTs per month. See Exhibit 2.

1. The general CRT production process

CRT manufacturers typically acquire the major components – funnel, panel, electron gun, and mask – from other facilities.³⁶ Most of the major components have additional processing done to them at the CRT plant, then are assembled into a CRT. The manufacturing process prepares the mask and, separately, applies the phosphors and other coatings to the panel. The mask and panel are then mated. The funnel is also coated, then the funnel and panel are joined in a process called “frit sealing”. The assembly is now called a “bulb”. The electron gun is inserted into the neck of the funnel and the funnel is sealed around the gun. The tube is annealed (heated) to remove residual stress and a vacuum is drawn inside the tube. Lastly, an external band is wrapped around the front of the tube where the panel and funnel are joined. This band has “lags” on it which are used to attach the tube to the TV or monitor chassis or frame.³⁷ At this point the product is a CRT or a bare CRT.

Before the CRT can create pictures, the deflection yoke and related components must be installed and properly adjusted. Deflection yoke installation is the last step of the CRT manufacturing process.³⁸ In this step, referred to variously as the ITC (“integrated tube component”) process,³⁹ “pinning”,⁴⁰ or “matching”,⁴¹ the deflection yoke and focusing magnet are installed and adjusted to generate the best picture.⁴² Depending on customer (finished product

³⁶ See, e.g.,

- A Chunghwa analysis of Japanese CRT manufacturers reports the main component suppliers for each CRT manufacturer. Chunghwa Picture Tubes, LTD, 1995, CRT Market Reporting Japanese Suppliers, CHU00028178 - CHU00028190, at 8179, 8182, 8184, and 8186.
- Some CRT manufacturers had “sister” companies that manufactured some of these components. See Chunghwa Picture Tubes, LTD, 14 March 2003, Chunghwa Picture Tubes, Ltd. and Subsidiaries Consolidated Financial Statements For The Years Ended December 31, 2002 and 2001 with Report of Independent Auditors, CHU00000207 - CHU00000259 at 0214 and 28 August 2006, Trustee’s Second Report in the bankruptcies of LG.Philips Displays Holding B.V. and LG.Philips Displays Netherlands B.V. and LG.Philips Displays Investment B.V., <http://deterinklive.com/nl/publicaties/faillissementsverslagen/l/>, accessed 12 July 2012, at 25.
- Samsung made its own deflection yokes for high-end products, but purchased others. They made their own electron guns. They purchased glass and masks. 06 June 2012, Deposition of Samsung SDI 30(b)(6) Witness Jaen Lee, Volume I (Hereinafter “Samsung SDI 30(b)(6) Deposition of Jaen Lee, Vol. I, 06 June 2012”), at 101:21-102:20.

³⁷ See SDI, Undated, Model of SDI CRT Product, SDCRT-0021278 - SDCRT-0021294 at 1290 – 1294 and Engelsens, Daniel den, 15 June 2000, Manufacturing of CRTs 1, SDCRT-0202981.

³⁸ 13 July 2012, Deposition of LG Electronics 30(b)(6) Witness Kyung Tae Kwon (Hereinafter “LGE 30(b)(6) Deposition of Kyung Tae Kwon, 13 July 2012”), at 106:7-107:1.

³⁹ Hitachi 30(b)(6) Deposition of Nobuhiko Kobayashi, 17 July 2012, at 22:11-23:6.

⁴⁰ Hitachi 30(b)(6) Deposition of Thomas Heiser, 03 July 2012, at 71:1-23.

⁴¹ Philips 30(b)(6) Deposition of Roger De Moor, 31 July 2012, at 18:5-19:15.

⁴² The deflection yoke uses magnetism to aim the electron beam. The electron beam, comprised of charged particles, is affected by not only the deflection yoke’s magnetic field, but also by the Earth’s magnetic field and the magnetic fields generated by various electrical components inside the television or monitor. During the ITC process, the

manufacturer) preferences, the yoke can be installed by the CRT manufacturer, the customer, or by third parties.⁴³ If the customer or a third party is performing the ITC process, the CRT can be sold without a deflection yoke, with the deflection yoke packed separately from the tube, or with the deflection yoke on the tube but not pinned.⁴⁴ Once the deflection yoke is installed and pinned, the product is an ITC or ITC CRT.

2. Production line flexibility allows for supply side substitution

Although there is almost no demand substitution between CDTs and CPTs, CRT production facilities have some capability for supply substitution by converting CRT production lines from producing tubes for one application to producing tubes of the other type. A few lines were capable of producing either type, with the switch from one type to the other needing relatively little time.⁴⁵ The line status reports⁴⁶ suggest that out of 322 lines that exhibited positive capacity covered by the reports, only 14 lines regularly or repeatedly produced both tube types; see Exhibit 3. However, switching production lines between CDTs and CPTs was relatively rare. Most CRT production lines produced exclusively CDTs or CPTs; see Exhibit 3. Of the 322 lines reported in the line status reports as having produced CRTs, at most 33 appear to have switched from producing exclusively CDT to exclusively CPT, or vice versa.

CRT production lines can relatively easily change the size of tubes they are producing. Almost all CRT production lines produced various size tubes over time and most were able to produce

deflection yoke is adjusted to compensate for the various magnetic fields affecting the beam and fastened rigidly to the neck of the funnel. See Hitachi 30(b)(6) Deposition of Nobuhiko Kobayashi, Vol. I, 17 July 2012, at 22:11-23:6 and LGE 30(b)(6) Deposition of Kyung Tae Kwon, 13 July 2012, at 106:7-107:1.

⁴³ See, e.g.,

- Hitachi sold both bare and ITC CRT. When Hitachi's "Set Division" (a finished product manufacturer) bought bare tubes, it performed the ITC process. Hitachi 30(b)(6) Deposition of Nobuhiko Kobayashi, Vol. I, 17 July 2012, at 45:18-46:21.
- When Samsung sold bare CRTs, the deflection yoke would be installed by the customer. Samsung SDI 30(b)(6) Deposition of Jaemin Lee, Vol. I, 06 June 2012, at 102:9-103:9.
- Hitachi outsourced the ITC process on occasion, over a period of several years. Samsung SDI 30(b)(6) Deposition of Jaemin Lee, Vol. I, 06 June 2012, at 88:7-89:2.
- Philips's Ottawa plant sold some tube bare, some ITC, and some were shipped to a plant in Juarez, Mexico which performed the ITC process for Philips Consumer Electronics plant in Juarez. Philips 30(b)(6) Deposition of Roger De Moor, 31 July 2012, at 18:5-9:15.
- LGE 30(b)(6) Deposition of Kyung Tae Kwon, 13 July 2012, at 106:7-107:1.

⁴⁴ For example, Samsung distinguished among bare (no deflection yoke or CPM), ITC (all components installed and adjusted to match finished product), "CKD" (complete knock down; ITC parts supplied but packed separately from CRT), and "SKD" (semi knock down; ITC parts installed but not adjusted). SDI, Undated, SDI CRT Model Number Decoder, SDCRT-0021274 - SDCRT-0021277, at 1277.

⁴⁵ For example, the #1 line at Samsung's Suwon plant could switch from making CDT to CPT or vice versa in about one shift, even though it required changing a lot of the production line. Samsung SDI 30(b)(6) Deposition of Jaemin Lee, Vol. I, 06 June 2012, at 113:8-114:3.

⁴⁶ "Line status reports" are documents produced by various cartel members that track worldwide CRT capacity on a company-by-company, line-by-line basis.

different sizes at any given time; see Exhibit 2. Some lines were capable of producing multiple sizes intermixed, rather than running one size for a while then switching to another size.⁴⁷

There are some costs to switch between two different tube specifications of a given size. For example, different customers might use different electron guns in the same basic tube, causing changes in how the guns were inserted. Adjusting lines for such changes might take two shifts.⁴⁸

3. The nature of CRT production creates barriers to entry and sunk costs

CRT manufacturing is a capital-intensive process characterized by economies of scale. At the beginning of the damages period, viable CPT factories should produce at least 1.0 million tubes per year.⁴⁹ CRT manufacturing facilities were built for under \$100 million to over \$300 million.⁵⁰ CRT manufacturing facilities that make larger tubes generally cost more.⁵¹ Adding

⁴⁷ “You could actually have a line going where your one device you’re hanging in the rack may be a 19 and the next one could be a 20...” TAEC 30(b)(6) Deposition of Jay Alan Heinecke, 31 July 2012, at 84:10-12.

⁴⁸ TAEC 30(b)(6) Deposition of Jay Alan Heinecke, 31 July 2012, at 82:10-83:15.

⁴⁹ See, e.g.,

- Sony and LG each built plants planned to produce 1 million units per year. Telecompaper, 20 July 1994, Sony Electronics to Invest in Cathode Ray Tube Plant, <http://www.telecompaper.com/news/sony-electronics-to-invest-in-cathode-ray-tube-plant>, accessed 22 March 2012 at 1 and Telecompaper, 06 September 1995, LG Electronics to Invest in CRT Plant, <http://www.telecompaper.com/news/lg-electronics-to-invest-in-crt-plant>, accessed 22 March 2012.
- One author asserts the minimum efficient scale for a CRT plant was 1.5 million units per year. Kenney, Martin, Undated, The Shifting Value Chain: The Television Industry in North America, http://hcd.ucdavis.edu/faculty/webpages/kenney/articles_files/The%20Shifting%20Value%20Chain:%20The%20Television%20Industry%20in%20North%20America.pdf, accessed 19 April 2012, at 105. This document appears to have been written no later than 1 August 2003.
- Note that 1.5 million CRT per year is 125,000 tubes per month. Many individual lines had capacity in excess of 125,000 tubes per month. Individual production lines range in capacity from 20,000 to over 300,000 tubes per month.

⁵⁰ See e.g.,

- A new CRT facility will cost approximately 10 billion yen or 120-130 million US dollars. Panasonic 30(b)(6) Deposition of Tatsuo Tobinaga, 16 July 2012, at 146:8-147:8, 151:15-152:11.
- An LG plant in Korea, for the production of 24"-32" CPTs beginning in 1996, cost \$125 million and was expected to produce 1 million CPTs per year. Telecompaper, 06 September 1995, LG Electronics to Invest in CRT Plant, <http://www.telecompaper.com/news/lg-electronics-to-invest-in-crt-plant>, accessed 22 March 2012.
- A Sony plant for 15" and 17" CDT with a capacity of 1 million units per year cost \$50 million. Telecompaper, 20 July 1994, Sony Electronics to Invest in Cathode Ray Tube Plant, <http://www.telecompaper.com/news/sony-electronics-to-invest-in-cathode-ray-tube-plant>, accessed 22 March 2012, at 1.
- In the late 1980s a large screen (25" or more) CRT manufacturing facility generally cost between \$200 and \$300 million. Kenney, Martin, Undated, The Shifting Value Chain: The Television Industry in North America, http://hcd.ucdavis.edu/faculty/webpages/kenney/articles_files/The%20Shifting%20Value%20Chain:%20The%20Television%20Industry%20in%20North%20America.pdf, accessed 19 April 2012, at 105.
- Pat Magrath of Georgetown Economic Services stated before the International Trade Commission on February 17, 2000 that CPT factories cost between \$70 and \$332 million to build. United States

capacity to an existing plant was also expensive.⁵² In addition, CRT manufacturing required substantial ongoing investments in capital.⁵³

Building a plant or adding a line also took a lot of time. Constructing the plant or line can take a year and require an additional year to get the completed line up to mass production.⁵⁴ For a line to reach full efficiency might take a further year or more of mass production.⁵⁵

International Trade Commission, 17 February 2000, United States International Trade Commission In the Matter of: Color Picture Tubes from Canada, Japan, Korea, and Singapore, SDCRT-0068880 - SDCRT-0069081, at 8922.

⁵¹ Kenney, Martin, Undated, The Shifting Value Chain: The Television Industry in North America, http://hcd.ucdavis.edu/faculty/webpages/kenney/articles_files/The%20Shifting%20Value%20Chain:%20The%20Television%20Industry%20in%20North%20America.pdf, accessed 19 April 2012, at 104-105.

⁵² See, e.g.,

- LG Philips planned to spend \$112 million installing two large/jumbo CPT lines at the Gomez Palacio plant in Mexico. ABN AMRO Bank, N.V., Citibank/Salomon Smith Barney Hong Kong Limited, et al., May 2001, LG.Philips Displays Holding B.V. US\$2,000,000,000 Senior Term Loan and Revolving Credit Facility, PHLP-CRT-051982 - PHLP-CRT-052085, at 2046 and 2078.
- Adding a line could cost as much as \$160 million. United States International Trade Commission, 17 February 2000, United States International Trade Commission In the Matter of: Color Picture Tubes from Canada, Japan, Korea, and Singapore, SDCRT-0068880 - SDCRT-0069081, at 8922.
- LG's investment plans for installing additional lines to produce its "Flatron" real flat CRTs ranged from 97 billion Won to 151 billion Won (at an exchange rate of 1200 Won per dollar, these convert to \$80 million to \$125 million per line). Salomon Smith Barney Inc., 22 May 2001, Project Mercury Confidential Information Memorandum, EIN0017699 - EIN0018075, at 7842.
- Philips spent \$24 million on two small lines (80k/month capacity) producing 17" CDTs. Display Monitor, 22 May 2000, SGI Uses Quadro In New Workstations, Display Monitor, Vol. 7(20), HEDUS-CRT00166844 - HEDUS-CRT00166863, at 6844.

⁵³ See, e.g.,

- LG's investment plans for updating existing lines to produce its "Flatron" real flat CRTs ranged from 22 billion to 68 billion Won (at an exchange of 1200 Won per dollar, these convert to \$18 million to \$56 million). Salomon Smith Barney Inc., 22 May 2001, Project Mercury Confidential Information Memorandum, EIN0017699 - EIN0018075, at 7842.
- Toshiba invested over \$150 million in its existing Horseheads, NY CRT plant in the five years up to March 2003. Panasonic, 27 March 2003, Matsushita and Toshiba To Launch North American Operations of New CRT Joint Venture, http://www.Panasonic.com/MECA/press_releases/toshiba_032703.pdf, accessed 10 July 2012, at 1. That is in addition to \$220 million spent in the mid-1980s refurbishing and expanding the same facility. Kenney, Martin, Undated, The Shifting Value Chain: The Television Industry in North America, http://hcd.ucdavis.edu/faculty/webpages/kenney/articles_files/The%20Shifting%20Value%20Chain:%20The%20Television%20Industry%20in%20North%20America.pdf, accessed 19 April 2012, at 105.

⁵⁴ See, e.g.,

- Building a facility can take a year and another year is required to get the line up to mass production speeds. Panasonic 30(b)(6) Deposition of Tatsuo Tobinaga, 16 July 2012, at 146:8-147:8.
- It can take two years to complete a plant or add a line. Testimony of Pat Magrath, United States International Trade Commission, 17 February 2000, United States International Trade Commission In the Matter of: Color Picture Tubes from Canada, Japan, Korea, and Singapore, SDCRT-0068880 - SDCRT-0069081, at 8922.

On top of the time and capital required, there is substantial risk involved in establishing a new CRT facility or line. Despite CRT manufacturing being a mature technology, manufacturers sometimes were unable to develop economical production on a given line or of a given product.⁵⁶

As an example, Philips established a plant in Nanjing, China, with an initial investment of \$100 million. The plant installed five production lines in two stages, three lines in the third quarter of 2000 and two more in the third quarter of 2001. However, the factory had problems attaining either adequate run rates or quality. By July 2002, LG Philips expected it might cost another \$15 million to \$25 million to revise the equipment, modify product designs, and correct operating processes.⁵⁷

Another example is Samtel. In April 2004 it announced a \$22 million project to add 1.5 million units of CPT capacity at its Ghaziabad, India plant with a May 2005 start date.⁵⁸ Line status reports from various Defendants indicate the start date was delayed, with mass production finally commencing after mid-March 2006.⁵⁹ However, despite the planned capacity of 125 thousand

⁵⁵ TAEC 30(b)(6) Deposition of Jay Alan Heinecke, 31 July 2012, at 249:13-17.

⁵⁶ See, e.g.,

- Toshiba's U.S. factory in Horseheads, NY, variously tried producing 27" CPTs, 17" CDTs and 19" tubes, and was unable to produce any of those products economically. Toshiba 30(b)(6) Deposition 31 July 2012, at 59:17-61:16.
- IRICO had problems with the varnish it used to hold its deflection yokes in place; the varnish was melting. This resulted in many CRT returns and IRICO had difficulties gaining sales thereafter. Chunghwa Picture Tubes, LTD, 23 June 2000, Visitation Report, Topic: TV Tube Market, CHU00029110 - CHU00029115, at 9114E.
- "The production lines at Huapu [a Philips plant in Nanjing, China] have not reached their nominal annual capacity of 4 m. tubes and are producing low quality tubes. As a result, Huapu's sales are far behind budget, while Huapu has too much B-grade products, too much inventory and is facing high product returns. Huapu's net income for 2002 is expected to end up at - 18.4 m. USD, washing out Huapu's entire equity. [para.] To tackle these issues, an extensive improvement plan is under preparation together with the new Plant Director, thereby addressing the inadequate equipment, product designs, operating processes and organizational competence. An investment in the range of 15 - 25 m. USD might be needed." L.G. Philips Displays Holding B.V., Undated, Minutes of the Supervisory Board Meeting of LG.Philips Displays Holding B.V., PHLP-CRT-002306 - PHLP-CRT-002481, at 2339.

⁵⁷ L.G. Philips Displays Holding B.V., Undated, Minutes of the Supervisory Board Meeting of LG.Philips Displays Holding B.V., PHLP-CRT-002306 - PHLP-CRT-002481, at 2339.

⁵⁸ LG Philips Displays, 27 July 2004, 40422+W_W_line--factory line summaries, LPD_00035873.

⁵⁹ See, e.g.,

- "Plan to start in '05" appears from Dec. 2004 to April 2005. LG Philips Displays, 20 December 2004, 04 12 CRT Line Status, LPD_00034786 and LG Philips Displays, 21 April 2005, 04-21-05 Worldwide prod lines - All LG Philips Displays, 21 April 2005, 04-21-05 Worldwide prod lines - All manufacturers, LPD_00042476.
- In June 2005, "Production start is delayed to 1Q2006." MT Picture Display, 04 July 2005, CRT Line Status Jun 05, MTPD-0575968.
- On March 15, 2006, "MP is not started yet". MT Picture Display, 02 April 2006, CRT Line Status Mar 06, MTPD-0468631.
- June 2006, "29F started in 1Q 06". MT Picture Display, 19 June 2006, CRT Line Status Jun 06, MTPD-0426099.

units per month (= 1.5 million per year), by August 2007 the line had a reported capacity of only 41.667 thousand units per month.⁶⁰

As indicated by the technical problems faced by various manufacturers, technical knowledge about CRT manufacturing was not always available. If such knowledge were readily available, manufacturers would not have abandoned attempts to introduce new products.⁶¹ As an example, when Irico was having technical problems, it first sought assistance from Toshiba, an investor in Irico at the time. When “Toshiba was not too enthusiastic in transferring technology”, Irico sought help from Chunghwa.⁶²

It is unclear how readily CRT plants can be used for purposes other than manufacturing CRTs. There is some testimony the plants have little other use.⁶³ However, it appears Chunghwa converted a CRT plant to produce plasma display panels after moving the CRT lines to a Chunghwa plant in China.⁶⁴

CRT manufacturing equipment is not useful for anything other than manufacturing CRTs.⁶⁵ Some manufacturers tried to sell disused lines, without success.⁶⁶

C. CRT industry structure

1. The cartel controlled most of CRT production and capacity

⁶⁰ LG Electronics, 09 August 2007, CRT Line Status, LGE00089431. In August 2009, the last of the line status reports I have found listing this line, the capacity was 83,000 units per month. LG Electronics, 10 August 2009, Global C-CRT Line Status, LGE00091898.

⁶¹ Here I refer specifically to products abandoned expressly due to technical inability to produce the product, as described earlier.

⁶² Chunghwa Picture Tubes, LTD, 23 June 2000, Visitation Report, Topic: TV Tube Market, CHU00029110 - CHU00029115, at 9114E.

⁶³ See, e.g.,

- “Q. Do you know whether CRT production facilities can be used for manufacturing anything other than CRTs? A. Based on my understanding, that's not possible.” Hitachi 30(b)(6) Deposition of Nobuhiko Kobayashi, 17 July 2012, at 93:7-11.
- MTPD’s Ohio plant is now producing garage “shutters” [doors?]; their Indonesian plant was demolished after they shut it down. Panasonic 30(b)(6) Deposition of Tatsuo Tobinaga, 16 July 2012, at 147:9-149:8.

⁶⁴ “Since late 2000, in order to take advantage of lower labor costs in the China, the Company began moving two 15 inch CDT production lines and two 17 inch CDT production lines from Taoyuan, Taiwan to Chunghwa Picture Tubes (Fuzhou) Ltd., and replacing those production lines with PDP (plasma display Panel.)” Chunghwa Picture Tubes, LTD, 15 August 2002, Chunghwa Picture Tubes, Ltd. Financial Statements For The Three-Month Period Ended March 31, 2002 and 2001 With Report of Independent Auditors, CHU00000260 - CHU00000304, at 0278.

⁶⁵ See, e.g.,

- Hitachi 30(b)(6) Deposition of Nobuhiko Kobayashi, 17 July 2012, at 93:21-25.
- Prior to 2004, MTPD sometimes overhauled lines that were being shut down at one plant and installed them at a different plant. It decided “it wasn’t possible to really create a very good facility doing it that way.” Its attempts to sell disused lines were unsuccessful. After 2004 or 2005, it decided to scrap the CRT lines when it shut them down. Panasonic 30(b)(6) Deposition of Tatsuo Tobinaga, 16 July 2012, at 149:6-8.

⁶⁶ See, e.g., “...did you ever sell any equipment to third parties? A. We tried that, but it wasn’t successful.” Panasonic 30(b)(6) Deposition of Tatsuo Tobinaga, 16 July 2012, at 147:9-149:8.

As noted above, customers generally cannot substitute between CDTs and CPTs. Production shares for CDTs and CPTs show the cartel members controlled a very large share of production of each type of tube; see Exhibits 4 and 5, respectively.

The Herfindahl-Hirschman Index (HHI) is widely used in scholarly research as well as in antitrust legal and economic analyses to measure the degree of concentration in an industry.⁶⁷ The HHI is based on the distribution of market shares across firms. Lower HHI values indicate a less concentrated market, with many firms each having low market share, and hence, more competitive conditions for market participants. According to the 2010 Horizontal Merger Guidelines, the U.S. Department of Justice (DOJ) considers markets with HHIs below 1500 to be “unconcentrated”, between 1500-2500 “moderately concentrated”, and above 2500 “highly concentrated”.⁶⁸ Production of each type of tube was highly concentrated with the cartel in place, with HHIs in excess of 8,000 for CDT production and 7,000 for CPT production. This is a dramatic contrast to the degree of concentration that would have existed absent the cartel. See Exhibits 6 and 7.

As noted above, some degree of supply substitution is possible: some lines were designed to be able to switch relatively quickly between CDT and CPT production and other lines were converted from producing one type of tube to the other. Therefore I also examined CRT manufacturing as a whole. With the cartel in place, CRT manufacturing was highly concentrated, with the HHI exceeding 7,800. Again, the concentration resulting from the cartel is in dramatic contrast to the concentration that would have existed absent the cartel. See Exhibit 8.

2. Falling demand and excess capacity cause sick industry problem

Falling demand and persistent excess capacity often cause the long-run decline of an industry. Noted antitrust scholars, Areeda, Hovenkamp, and Solow say:

When demand for a product declines, competition drives price below full costs, including a competitive return on capital; producers will continue to earn less than a competitive return until the excess capacity is withdrawn... Barriers to mobility prolong and magnify the losses; competition may become “ruinous.”... Until it wears out, plant or equipment will continue in operation so long as price exceeds variable costs, because some return on investment is better than nothing. Thus price can fall and remain well below full costs for an extended period before capacities are reduced enough to restore profitable operations.⁶⁹

⁶⁷ The Herfindahl-Hirschman Index (HHI) is calculated by summing the squares of the market shares of all participants in the relevant market. In the case of a pure monopoly, the Herfindahl takes the value of 10,000 (100 squared). In the case of perfect competition (in which no single firm has a large market share), the index will tend toward zero. The U.S. Department of Justice and Federal Trade Commission use Herfindahl indexes as one of the tools to assess competitive conditions. U.S. Department of Justice and Federal Trade Commission, 19 August 2010, 2010 Horizontal Merger Guidelines.

⁶⁸ Department of Justice and Federal Trade Commission, 18 August 2010, 2010 Horizontal Merger Guidelines, at Section 5.3 Market Concentration.

⁶⁹ Areeda, Philip E., Hovenkamp, Herbert, et al., 2007, *Antitrust Law: An Analysis of Antitrust Principles and Their Application*, Volume IIB, Third Edition, Aspen Publishers, at ¶413a.

Scherer and Ross, in a classic Industrial Organization textbook, call the phenomenon described by Areeda, Hovenkamp, and Solow the “sick industry problem”, and state conditions necessary for the problem to arise:

The cutthroat competition issue has two principal branches. One pertains to industries with chronic excess capacity because superior substitutes have appeared on the scene... the case of the secularly declining or “sick” industry. There are two chief prerequisites: capacity substantially in excess of current and probable future demands and rigidities that retard the reallocation of capital and/or labor toward growing industries. Then unless there is some artificial restraint such as ... tightly knit cartel agreements, competition is likely to drive prices down to levels that yield investors much less than a normal return on their capital. ...When firms’ cost structures include a high proportion of fixed costs, this profitless existence can continue for years or even (as in railroading and coal mining) for decades, since producers find it preferable to continue operation and cover at least their ... variable costs than to shut down.⁷⁰

a) The CRT industry suffered from falling demand

LCD technology is a functional substitute for CRT technology, i.e., it performs a similar function for the end-user. LCD technology’s primary benefit is to reduce the size and weight of a monitor or television. LCDs were not practical alternatives to CRTs until the early- to mid-2000s when LCD manufacturing costs fell significantly. Even then, LCD monitors and TVs were far more expensive than comparable CRT finished goods and as a result did not constrain the price that Defendants could charge for CRTs.⁷¹

However, the growing popularity of LCD technology, first for monitors and then TVs, did result in a shrinking market for CRTs. As a result, production capacity significantly exceeded demand for CRTs beginning by the early 2000s.

b) Excess production capacity existed throughout the damages period

Throughout the relevant period, CRT manufacturing capacity exceeded quantity demanded at the cartelized market prices for both CDTs and CPTs.

(1) There was excess CDT capacity

⁷⁰ Scherer, F.M. and David Ross, 1990, *Industrial Market Structure and Economic Performance*, Third Edition, Houghton Mifflin Company: Boston, at 294.

⁷¹ If the availability of Product A limits the price at which suppliers can sell Product B, then Product A constrains the price of Product B. Two products may be functional substitutes – that is, they perform the same function – without constraining sellers’ pricing decisions. For example, a Ferrari sports car and a Honda Civic are functional substitutes because they both provide automotive transportation. However, the price and performance characteristics of the two vehicles are so different that the availability of the Ferrari does not constrain the price that Honda can charge for a Civic and vice versa. The vehicles are not price constraining substitutes. See Section VIII.A.2.c) for a more detailed discussion of economic substitutes and market power.

Toshiba described CDT manufacturing as having “much excess” capacity and the ability to “easily increase” production in the late 1990s.⁷² By Toshiba’s calculations, capacity equaled output in 1995 and thereafter exceeded output by 19% in 1996, 31% in 1997, 37% in 1998, 35% in 1999, and 27% in 2000.⁷³

In 2000-2001, the dot-com crash depressed computer sales.⁷⁴ Unit sales of all types of computer monitors declined 3% from 2000 to 2001.⁷⁵ To make matters worse for CDT manufacturers, consumer demand was shifting away from CRT monitors to LCD monitors: LCD monitors rose from 5% of units in 2000 to 15% in 2001. The shift to LCDs was occurring despite LCD monitor prices being four to five times the amount of CRT monitors of the same size.⁷⁶

This double blow had a very significant impact on CDT manufacturing, with most vendors reporting very low utilization rates in 2001.⁷⁷ Matsushita and TECO halted production and Orion was “struggling for survival”.⁷⁸

CDT production never recovered. When monitor demand began growing again, LCD panels, not CDTs, benefited from the recovery. LCD monitors went from 15% of the market in 2001 to 28% in 2002 and captured half the market by 2004, again despite pricing that, by 2004, had LCD monitors at 2.5 times the price of CRT monitors of the same size.⁷⁹

(2) There was excess CPT capacity

Total output of CPTs rose from the start of the relevant period until it peaked in 2004. However, from 2000 onward, the increase in CPT output was less than the decline in CDT output, with total output of CRTs never regaining the 2000 peak. See Exhibit 9.

As noted above, CDT capacity can be converted to produce CPTs. There was excess CDT capacity in 2000, which would only increase as CDT demand decreased.⁸⁰ Thus, the amount of CDT capacity becoming available for conversion to CPT production exceeded any growth in

⁷² “But CDT capacity is much excess (135% in 99) vs CDT demand ==>>> CDT supply can be easily increased, if necessary.” Toshiba America Electronic Components, Inc., 21 July 1999, CDT & Monitor Demand Supply Analysis, TAEC-CRT-00065484, at Tab ‘topics’, K6:K7.

⁷³ See Toshiba America Electronic Components, Inc., 21 July 1999, CDT & Monitor Demand Supply Analysis, TAEC-CRT-00065484, Tab ‘MNTR VS CDT (2)’, row 92 and Toshiba Electronics Taiwan, 24 April 2001, CDT & Monitor Demand Supply Analysis, TET-CRT-00003403, at Tab ‘Deman&Supply graph’, row 37.

⁷⁴ PC shipment data show unit sales in the 2nd quarter 2001 had fallen below prior year sales. The data also indicate full-year 2001 PC shipments were expected to be about 6% lower than 2000. Toshiba America Electronics Components, 2001, PC Shipments by Quarter, 1994-2002, TAEC-CRT-00018123.

⁷⁵ DisplaySearch, May 2011, Analysis Group, Inc. Custom Data Project, DISP_LCD_000128.

⁷⁶ DisplaySearch, May 2011, Analysis Group, Inc. Custom Data Project, DISP_LCD_000128.

⁷⁷ SDI had “the best loading in the industry (~75%)”, Chunghwa was at 60%, Philips at 60%-65%, LG at 55%-60%, HTC at less than 40%, Toshiba at 60%, Sony at 50%, and Mitsubishi at 58%. Baran, Milan, 08 May 2001, E-mail, Subject: CDT Price Guideline for May 2001, PHLP-CRT-026590, at 6591-6592.

⁷⁸ Baran, Milan, 08 May 2001, E-mail, Subject: CDT Price Guideline for May 2001, PHLP-CRT-026590, at 6591 - 6592.

⁷⁹ DisplaySearch, May 2011, Analysis Group, Inc. Custom Data Project, DISP_LCD_000128.

⁸⁰ As noted above, CRT production equipment has no value in other uses and, with CPT production continuing, the plants themselves needed to be retained. This means idled CDT capacity would grow as demand declined.

CPT demand from 2000 onward. In 2000, CPT manufacturers' available capacity, "without overtime", was 16% greater than their production and the gap was expected to increase to 19% for the full year 2001.⁸¹ As noted above, CDT manufacturers had 27% excess capacity in 2000. With excess capacity in both CPT and CDT in 2000, and declining total CRT demand thereafter, excess capacity among incumbents must have grown after 2000. Because CRT production facilities and equipment are not readily used for other purposes, the excess capacity problem looked likely to persist.

c) Cartel members recognized their industry was in secular decline and, but for the cartel, would have engaged in "ruinous" competition

The CRT industry satisfied the two conditions – secular decline in demand and excess capacity – necessary for the "sick industry problem". Statements from industry participants match economists' predictions for firms in a sick industry: they would have been willing to price below average total costs, ignoring their cost of capital (as reflected in accountant's depreciation):

"...current management strategy is to balance actual revenue and expenditure. In other words, whether there is a loss on the books would not be the standard. For example, depreciation is just a book term and has no impact on actual cash losses or actual revenue and expenditure."⁸²

"As you know, Thomson has announced write-off of assets for their Mexicali factory a few weeks ago. As a result, their cost structure is similar to [LPD's Gomez Palacio CRT plant in Mexico] (no depreciation expense)."⁸³

The industry participants also recognized that the solution to a decline in demand and excess capacity was cooperation and coordination, absent which ruinous competition would occur:

"Price erosion is only indirectly driven by LCD penetration but rather by head on competition among the remaining CDT producers"⁸⁴

"Also, the CRT TV market will not be able to prevent an LCD invasion, so expect CRT market demand to continuously decrease. Cooperation within the industry is critical and is a survival issue. If there is proper cooperation within the industry during the first half of the year, there should not be an inventory issue and we may prevent loss due to a price drop. Therefore cooperation is important even during the off-season next year."⁸⁵

D. Some cartel members were vertically integrated⁸⁶

⁸¹ Chunghwa Picture Tubes, LTD, October 2001, LINE Status by Maker, CHU00125296.

⁸² This is the view of Thai-CRT, as reported in notes from a cartel meeting. CPT, February 2003, Comprehensive Report Regarding Marketing Contacts, CHU00030080 - CHU00030081, at 0080.02E.

⁸³ Canavan, Pat, 15 November 2004, E-mail, Subject: Re: 29RF global pricing status, PHLP-CRT-023911 - PHLP-CRT-023915, at 3914.

⁸⁴ LG Philips Displays, 02 December 2003, LG.Philips Displays to restructure its European industrial production infrastructure, PHLP-CRT-001323 - PHLP-CRT-001556, at 1487.

⁸⁵ Samsung SDI, August 2005, Competitor China Visit Report, SDCRT-0091524 - SDCRT-0091530, at 1528E.

⁸⁶ See Appendix A of my Class Certification report for evidence underlying this section.

Many CRT manufacturers were vertically integrated into downstream production, manufacturing finished goods incorporating CRTs as well as CRTs themselves. For example, cartel members Hitachi, LGE, Panasonic/Matsushita, Philips, Samsung, Thomson, and Toshiba are familiar brand names for computer monitors and televisions. Outside the cartel, Sony is another CRT manufacturer that is a familiar brand name, vertically integrated into finished product manufacturing. When the two big CRT joint ventures, LG Philips and MTPD, were formed, neither entity included the parent firms' finished product divisions, but these CRT joint ventures continued to supply the parent firms' finished product divisions.

E. Distribution of CRT monitors and TVs

CRTs travel from Defendants to class members through a distribution chain which generally includes the following levels:

- CRT manufacturers sell tubes to product manufacturers (sometimes via a distributor).
- CRT product manufacturers sell CRT monitors and TVs to retailers (sometimes via a distributor).⁸⁷
- Retailers sell the CRT products to class members.

The distribution system is largely the same for both CRT monitors and CRT TVs. For a graphical depiction of the distribution system, see Exhibit 10.

1. Direct purchasers

CRT manufacturers sell to two types of direct purchasers: CRT distributors (firms that distribute CRTs to other firms that incorporate the CRTs into CRT products) and product manufacturers (firms that incorporate CRTs into CRT products).

a) CRT distributors

Distributors buy and sell large quantities of CRTs. Several CRT manufacturers distribute CRTs via affiliated distributors. For example, TAEC is a Toshiba subsidiary that functions as a distributor of Toshiba tubes in North America; LG Philips Displays USA distributed tubes for LPD; and Samsung SDI America distributed tubes for Samsung.⁸⁸ Other Defendants also have

⁸⁷ Some product manufacturers, such as Dell, also sell directly to class members.

⁸⁸ See, e.g.,

- Toshiba America, Inc. (TAI) is the 100 percent shareholder for Toshiba American Electronic Components (TAEC) and Toshiba Corporation in Japan owns 100 percent of TAI. TAEC 30(b)(6) Deposition of Jay Alan Heinecke, 31 July 2012, at 158.
- TAEC testified that its role was to distribute Toshiba panels to customers in North America: "Q. Okay. If the CDT was coming to North America however, you would take title; TAEC would take title? A. If the – if their – yes. If it came into North America, TAEC was the sales arm to the monitor assembler." TAEC 30(b)(6) Deposition of Jay Alan Heinecke, 31 July 2012, at 143:4-143:8.
- LG.Philips Displays USA was LPD's U.S. distributor. A.A.M. Deterink, 28 August 2006, Trustee's Second Report in the bankruptcies of LG.Philips Displays Holding B.V. and LG.Philips Displays Netherlands B.V. and LG.Philips Displays Investment B.V., <http://deterinklive.com/nl/publicaties/faillissementsverslagen/l/>, accessed 12 July 2012, at 28.

affiliated companies that act as CRT distributors. It appears that there were very limited, if any, sales of CRTs to third party distributors.

b) CRT product manufacturers

Product manufacturers obtain inputs, including CRTs, and assemble them into computer monitors and TVs. During the manufacturing process, the CRT itself is not modified, but is combined with other inputs to assemble the monitor or TV. Product manufacturers operate under a variety of business models; however, these firms perform the same basic function—they manufacture monitors and TVs using CRTs. Below are descriptions of the various business models employed by product manufacturers.

- Original Equipment Manufacturers (OEMs) sell finished products under their own brand name. An OEM may be responsible for all the design and manufacturing of the finished CRT product, but also may contract some, or even all, engineering and manufacturing to contract manufacturers (CMs).⁸⁹
- Contract Manufacturers (CM) make components or finished CRT products for other suppliers of CRT products; these products are sold under the name of the customer ordering the product. There are two types of CRT contract manufacturers, Electronics Manufacturing Services (EMSs) and Original Design Manufacturers (ODMs).
- EMS providers manufacture components and CRT products for their customers, but do not own the IP for the product or its design. EMSs may also provide additional services such as product design or supply chain management.⁹⁰

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- Samsung SDI America is Samsung's U.S. sales corporation for CPTs. Samsung, 2001, Consolidated Balance Sheets, SDCRT-0000039 - SDCRT-0000081, at 0050.

⁸⁹ Even if assembly of the CRT product is carried out by a CM, the OEM may still negotiate directly with the CRT manufacturers for the terms and conditions on which CRTs will be delivered to the CMs. See, e.g., "Our component sourcing and product development staff researches, develops and tests the latest display technologies with our component suppliers and contract manufacturers, and is charged with designing and developing the highest quality display products at selected price points. We have established relationships with multiple sources of display components and multiple display manufacturers, and qualify additional component suppliers and contract manufacturers when advantageous to us. We currently obtain display components from multiple suppliers, including Hitachi, Intel, LG-Philips, Samsung, Quanta and Chi-Mei." Viewsonic Corporation, 29 March 2005, Viewsonic Corporation 10-K 2004, http://www.SEC.gov/Archives/edgar/data/1068806/000101540205001539/form10k_123104.htm, accessed 17 March 2014, at 4.

⁹⁰ See, e.g.,

- Sitronics, a European electronics company, defines Electronics Manufacturing Services (EMS) companies as "[a] company that provides design, testing, manufacturing, distribution and return/repair services for electronic components and assemblies for original equipment manufacturers." Sitronics, Undated, Glossary, <http://www.sitronics.com/investors/glossary/>, accessed 17 March 2014, at 3.
- "The EMS provider is usually engaged in a number of product verticals and offers diverse operation-oriented services ranging from PCB assembly, box assembly, sub-unit assembly to logistics. And the EMS provider has multiple facilities in the world serving different purposes and clients." 10 November 2005, An Interview with iSuppli's Jeffrey Wu - ODM vs EMS, what happens next?, EMSNow, <http://www.emsnow.com/npps/story.cfm?ID=15416>, accessed 18 June 2008, at 1.

- ODMs design and manufacture CRT products to be sold under their customers' brand name.⁹¹ Unlike an EMS, an ODM generally owns or licenses the IP for the product and its design,⁹² but in some cases, ODMs design products according to customer specifications.⁹³ ODMs also may perform all of the design work, offering products that are customized only by adding the customer's brand name prior to sale.⁹⁴ ODMs may manufacture products that are sold under many different brand names.⁹⁵ In addition, some ODMs may also market products under their own brand name.⁹⁶ ODMs may ship finished products directly to distributors or retailers, bypassing the OEM whose name appears on the product.⁹⁷
- Systems Integrators (SIs) operate very similarly to OEMs, but differ in that they make unbranded or "white-box" computer systems, including monitors.⁹⁸ It does not appear that SIs or systems builders make TVs.

2. Indirect purchasers

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- ⁹¹ ". . . an ODM is a company that manufactures products of its own designs, which are then sold under an OEM's brand name." Weber, Austin, 01 February 2003, Outsourcing's Alphabet Soup, Assembly Magazine, http://www.assemblymag.com/copyright/9411390b7d5c9010VgnVCM100000f932a8c0____?view=print, accessed 18 June 2008, at 1.
 - ⁹² "An ODM performs all the functions traditionally associated with EMS firms, in addition to actually designing products based on their own intellectual property." Weber, Austin, 01 February 2003, Outsourcing's Alphabet Soup, Assembly Magazine, http://www.assemblymag.com/copyright/9411390b7d5c9010VgnVCM100000f932a8c0____?view=print, accessed 18 June 2008, at 1.
 - ⁹³ "In the 'Design It' strategy, the OEM involves the ODM in the product design stage to different degrees, depending on the OEM's resource constraints and long-term R&D planning." 10 November 2005, An Interview with iSuppli's Jeffery Wu - ODM vs EMS, what happens next?, EMSNow, <http://www.emsnow.com/npps/story.cfm?ID=15416>, accessed 18 June 2008, at 1.

⁹⁴ "Now the outsourcing decision is getting complex because of growing demand for original design manufacturers (ODMs). ODMs not only build a product, but also design it for an OEM. The ODM owns the intellectual property or they license it." Carbone, Jim, 16 January 2003, ODMs offer design expertise; quicker time to market, http://www.purchasing.com/index.ASP?layout=articlePrint&articleID=CA269147&article_prefix=CA&article_id=269147, accessed 01 February 2008, at 1.

⁹⁵ "In many cases, the ODM will design and build products, such as VCRs or televisions, and sell the products to multiple OEMs. The OEMs then market the products under their own brand names." Carbone, Jim, 16 January 2003, ODMs offer design expertise, quicker time to market, Purchasing, http://www.purchasing.com/index.asp?layout=articlePrint&articleID=CA269147&article_prefix=CA&article_id=269147, accessed 01 January 2008, at 1.

⁹⁶ BenQ, a CRT finished product manufacturer, employs both the ODM and OEM business model. 10 November 2005, An Interview with iSuppli's Jeffery Wu - ODM vs EMS, what happens next?, EMSNow, <http://www.emsnow.com/npps/story.cfm?ID=15416>, accessed 18 June 2008, at 1.

⁹⁷ The distinction between ODMs and EMSs is diminishing as EMS providers acquire design capability. However, ODMs tend to specialize in only a few products where EMSs are usually engaged in a number of vertical product markets. 10 November 2005, An Interview with iSuppli's Jeffery Wu - ODM vs. EMS, what happens next?, EMSNow, <http://www.emsnow.com/npps/story.cfm?ID=15416>, accessed 18 June 2008, at 1.

⁹⁸ 31 March 2014, White box (computer hardware), Wikipedia, [http://en.wikipedia.org/wiki/White_box_\(computer_hardware\)](http://en.wikipedia.org/wiki/White_box_(computer_hardware)), accessed 31 March 2014.

Product manufacturers sell CRT products either directly to retailers or to distributors that subsequently resell the CRT products to retailers. These retailers and distributors are indirect purchasers of CRT products; that is, they are not purchasing directly from the CRT manufacturers.

a) Product distributors

Finished CRT products can be shipped to retail markets through independent distributors. These distributors are responsible for maintaining product inventory and preparing it for shipment. Distributors usually ship products to retailers that, in turn, resell to end customers; however, distributors sometimes drop-ship products directly to end customers who purchase through a retailer.⁹⁹

b) Retailers

Retailers sell finished CRT products to end consumers. These retailers include “big box” electronics retailers, specialty retailers, on-line merchants, and direct sales from OEMs to consumers. There are two general types of retail stores: brick-and-mortar stores (e.g., Best Buy, Radio Shack, Staples, Circuit City, Target, and Wal-Mart) and online retailers (e.g., Amazon.com, Buy.com, Dell.com, hp.com, Newegg, PC Mall).¹⁰⁰

3. Final consumers (class members)

End-customers purchase CRT products for their own use and do not resell them. End-customers are indirect purchasers that typically purchase CRT monitors and TVs from retailers; however, in some circumstances they purchase CRT products directly from product manufacturers. In the latter scenario, end-customers are still indirect purchasers of CRTs since the product manufacturer is the entity that purchases CRTs and resells CRT products to the end-customers.

VII. The economics of cartels

I discussed the basic economics of cartels in my expert report in support of class certification.¹⁰¹ For convenience, I have included that discussion as Appendix 1 of this report. There are four important points that are relevant to the economic analysis of whether the CRT cartel caused antitrust injury:

- A successful or effective cartel raises prices above the level they would have been but for the collusive conduct. I call the price that would have prevailed absent the cartel the

⁹⁹ Klein, Karen E., 22 September 2009, How Drop-Shipping Works for Retailers and Manufacturers - Businessweek, Bloomberg Businessweek, http://www.businessweek.com/smallbiz/content/sep2009/sb20090922_341780.htm, accessed 28 March 2014.

¹⁰⁰ Generally, brick-and-mortar stores also sell some products online, while online retailers typically sell online exclusively.

¹⁰¹ Netz, Janet S., 01 October 2012, Declaration of Janet S. Netz, Ph.D., In Support of Motion of Indirect-Purchaser Plaintiffs For Class Certification, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division) (Hereinafter “Netz Class Cert Report”).

“competitive price”¹⁰² or the “but-for price”. A successful cartel, as I use the term, necessarily causes antitrust harm.

- Prices can be above the competitive level even if prices are falling over time. That is, falling prices do not indicate a lack of antitrust harm. The appropriate comparison for examining the success of a cartel is the actual cartel price compared to the but-for price, not the actual cartel price in one period compared to the next.¹⁰³
- Cartel success is a matter of degree. A perfect cartel would set the monopoly price, which maximizes the joint profits the cartel members can earn as a cartel. However, a cartel can be successful even if it fails to raise prices to the monopoly level, as long as cartel prices are above the competitive level. Thus, the observation of some degree of cartel members “cheating” by charging customers lower prices and producing more than agreed is consistent with a successful cartel.¹⁰⁴
- A cartel can be successful even if some members are vertically integrated downstream and others are not. Both vertically integrated and unintegrated cartel members profit from an upstream cartel. A vertically integrated cartel member profits from the higher prices for intermediate goods sold to unrelated firms and from the higher prices for finished goods produced by its downstream subsidiary that result from the higher prices charged to unrelated firms. An unintegrated cartel member profits only via the first mechanism.

VIII. The CRT cartel caused class members to pay higher prices

Based on the analyses described below, I conclude that the cartel increased prices to direct purchasers and that the overcharge was passed through to class members.

A. The cartel increased prices to direct purchasers

In this section, I describe the economic analysis I undertook to determine whether the cartel increased prices to direct customers. I start by considering the cartel’s statements and actions; both support my conclusion that the cartel did increase prices. I then examine the cartel’s market power and various industry characteristics that might, but don’t, eliminate the cartel’s market power or its ability to exercise its market power. I then evaluate the cartel’s practices and their impact on prices. Finally I engage in an econometric analysis that directly shows higher prices resulting from the cartel’s actions.

All of this evidence and analyses support my conclusion that the cartel caused the prices to direct purchasers to be above the competitive level.

¹⁰² The “competitive price” is not to be confused with the equilibrium price in a perfectly competitive market. Most markets are not perfectly competitive even if free of monopolizing conduct such as cartelization; the “competitive price” is therefore not, in general, equal to the equilibrium price in a perfectly competitive market. Rather, it is the price that would prevail if cartel members competed freely with each other rather than colluding.

¹⁰³ Actual prices in time periods outside the cartel can be used to estimate the but-for price, which can then be compared to the actual price charged during the cartel.

¹⁰⁴ Bernheim, B. Douglas and Erik Madson, March 2014, Price Cutting and Business Stealing in Imperfect Cartels, NBER Working Paper Series 19993.

1. The cartel's success is demonstrated by the statements and conduct of cartel members

a) Cartel members reported they could and did raise prices

Cartel members were well-placed to know whether the cartel's efforts to set prices above the competitive level were successful. In contemporaneous business documents, including notes from cartel meetings, cartel members repeatedly declared their ability and intent to raise and maintain the prices of CPTs¹⁰⁵ and CDTs¹⁰⁶ above the competitive level.¹⁰⁷ Cartel members also regularly reported their success in raising or maintaining prices¹⁰⁸ for CPTs¹⁰⁹ and CDTs.¹¹⁰

¹⁰⁵ See, e.g.,

- From meeting notes: "Suggestion to Top Management 1. Every CPT maker's situation is getting improved in 14"/20"/21" together. Even with limited information of today, we can forecast the balance situation of supply and demand from June and July. And glass bulb price was increased from 2Q. 2. So, we believe that price can be increased from 3Q. 3. But, TV & DSP [display or monitor] market are quite different, the action must be taken very carefully. So we would like to suggest Guideline of price and timing expected be decided on the meeting of Apr. 15. Finally, CPT maker need to have a meeting to discuss detailed action plan to increase the price from 3Q in the beginning of May." Chunghwa Picture Tubes, LTD, 09 April 1999, Visitation Report, Subject: 14", 20", 21" CPT Respective Makers' Recent Status and Price Opinion Review, CHU00028606 - CHU00028608, at 8608.01E.
- From meeting notes: "With makers' changing lines, a shortage is likely to happen. As long as everybody cooperates, a price rise adjustment would definitely be successful." Du, Ching-Yuan (Michael), Hsieh, et al., 01 June 1999, CPT Sales Department Business Meeting Report, CHU00029189 - CHU00029190, at 9189E.
- From meeting notes: "For the price rise this time, although customers have not confirmed acceptance, SDI [Samsung] Mr. Park claimed that SDI has discussed the new price with almost all customers, and felt that the customers were not as resistant to price increases as last time. Thus, he thinks that the price increase this time should be easier than last time. In addition, OEC [Orion] Mr. Lee also claimed that Funai had no particular comment on the price increase. So OEC also thinks that the price can be raised smoothly and successfully." Chunghwa Picture Tubes, LTD, 24 March 2000, Visitation Report, Topic: Market Information Exchange and Price Review, CHU00029144 - CHU00029146, at 9146.02E.
- From meeting notes: "The supply and demand in the market of 20"/21"/21"F tubes next year are more heated than this year and the price raise in the European Market should be successful." Chunghwa Picture Tubes, LTD, 25 October 2000, Visit Report, Topic: Exchange of CPT market information and review of price, supply and demand, CHU00028975 - CHU00028976, at 8976.02E.

¹⁰⁶ See, e.g.,

- From meeting notes: "Directory [sic] Liu again patiently explained about the price raise background/ current price of various CRT makers/ situation of monitor makers/ HTC [Hitachi] 14" and 15" are no long [sic] the main stream and in April, HTC has raised the price slightly by USD 1-2.00 as well as other points of suspicion. This was to let him understand that there was already certain degree of success in following of price rise. There should not be any pressure from the customers. Furthermore, this was beneficial to his company's operation/ as well as to the overall industry." CPT, Liu, Chih-Chun (C.C.), et al., 23 April 1997, Visitation Report, CHU00028503 - CHU00028504, at 8504E.
- Manager Jian-Lung Zhang from Hitachi "indicated that he welcomes the price increase. He personally believes that if there can be another increase in October, HTC would follow." Chunghwa Picture Tubes, LTD, 21 August 1998, Sales Department Customer Contact Report, CHU00028385 - CHU00028387, at 2386E
- From meeting notes: "SDI [Samsung] also brought up that there should be a price increase for the 14" CDT because its demand exceeds its supply. Employee replied that it must be decided and passed through the

headquarter GLASS MEETING. There is optimism for success.” Chunghwa Picture Tubes, LTD, 06 April 2000, CPTF [Chunghwa Picture Tubes Fuzhou] Sales Department Visitation Report, Meeting Main Topic: China CDT Market Exchange, CHU00030992 - CHU00030994, at 0993.01E.

- From meeting notes: “Manager Chang claims that regarding China and Korea maker's 14"/15"/17" CDT price increase, HTC [Hitachi] itself also intends to increase. Its headquarters' resolution is that if prices have definitely increased, HTC guarantees that it would FLW.” CPT [Chunghwa], Du, Ching-Yuan (Michael), et al., 16 June 2000, Contact Report, CHU00028377, at 8378E.

¹⁰⁷ See, e.g.,

- Chih Chun-Liu, VP of sales at Chunghwa from 2000 to 2005, testified on the cartel's success. “Q. Do you agree, Mr. Liu, that in times of over-supply these group competitor meetings helped keep prices from falling as much as they would have? [objections omitted] THE WITNESS: Agree. BY MS. BERNSTEIN: Q. And when there was a shortage of tubes, sir, do you agree that these group competitor meetings allowed suppliers to raise prices faster? [objections omitted] THE WITNESS: Agreed.” 20 February 2013, Deposition of Chih Chun-Liu, Volume II, at 364:19 - 365:10.
- A 1999 review of the working-level cartel meetings stated that “because of the success of the Glass Meeting, everybody has been Enjoying Business [sic] this year” and called for continued cooperation. “Review of the implementation method of the Working Level weekly meeting: Each maker indicated that because of the success of Glass Meeting, everybody has been Enjoying Business this year. Now that the Slow Season is coming, everybody should continue to strengthen communications and contacts, so the weekly meetings should continue to be held on time.” Chunghwa Picture Tubes, LTD, 09 November 1999, Visitation Report, CHU00030916 - CHU00030918, at 0916.02E.

¹⁰⁸ Recall that when prices are generally declining, a cartel may collude in order to maintain constant prices, which are above competitive prices. See Section VII and Appendix 1.

¹⁰⁹ See, e.g.,

- Meeting notes referring to LPD's 14" CPT price increase: “An increase of \$0.5 (\$18.5/April -) was obtained.” Nishimura, Tanaha, 22 March 2004, Letter, Discard immediately after reading / Do not save to PC / Forwarding prohibited, MTPD-0419572 - MTPD-0419573, at 9572E.
- From CPT meeting notes: “SDD [Samsung] said that BMCC [Matsushita] has raised its original Bare Tube sales price of USD 29.5 for MTV to USD 30.5 following communications with SDD.” Chunghwa Picture Tubes, LTD, 23 August 1999, Visitation Report (Submit), CHU00029179 - CHU00029184, at 9179.02E.
- From Chunghwa's notes from a meeting with Matsushita Electronic Corporation (Malaysia): “He explained fully the situation of current price increase. Price of 20" was also successfully raised by \$1-\$2. Furthermore now all 20" supplying makers were all very tight (other than SDEM [Samsung Electron Devices (Malaysia)] which was slightly loose), Matsushita should be able to adjust its prices in good time. Mr. Tomori indicated that internally there was already a plan and would negotiate with customers shortly. It would start raising 20" price in October.” Chunghwa Picture Tubes (Malaysia), Yang, Sheng-Jen (S.J.), 07 September 1999, CPT Sales & Marketing Division Visiting Report, CHU00028438, at 8438.02E.
- “As far as the 14"/20" tube price increases are concerned, other than Thai-CRT not attending the meeting, so Thai-CRT's 20" price for July TCE/Funai is yet to be confirmed, all attendees believe that the price increase has been a full success. Mr. Chairman expressed gratitude for everyone's cooperation and hard work.” Chunghwa Picture Tubes, LTD, 13 July 2000, Visitation Report, Topic: Market Information Exchange and Price Review, CHU00029108 - CHU00029109, at 9109E.
- From June 2000 meeting notes: “CPT Tube: Director Liu explained that after China and Korea makers communicated with and explained the market status to related makers individually, of the China makers who were originally exporting the 21" tube with low prices, PH Nanjing has already increased \$0.5/pcs in May. It plans to adjust another \$12/pcs in August. HTC Shenzhen also agreed to increase the current price of Bare \$48-\$49/pcs, to \$51/pcs in August. The price increase of 20" tubes in Southeast Asia is also very successful. Customers such as Funai/TCE/AIWA/JVC, etc. have all accepted new prices of \$49/pcs or

b) Cartel members reported they could and did restrict output and capacity to raise price

A cartel possesses market power if it can raise price by restricting the output of its members relative to what members would have produced if there were no cartel.¹¹¹ The cartel meeting

more. Prices for medium and small-size customers such as Silver are at \$50/pcs. [Break] Mr. Matsumoto thanked CPT for its explanation and promised to take action to announce the price increase of 20"/21" tubes to customers." CPT, Liu, et al., 21 June 2000, Visitation Report (Submit), CHU00028424, at 8424.01E - 8424.02E.

¹¹⁰ See, e.g.,

- "CPTM [Chunghwa Malaysia] explained the price increase actions of CPT Group [Chunghwa Group]. The price increase for CDT (0.39/0.28) was implemented in the middle of May with a US\$7.00 increase; moreover, all customers have accepted. The price for CPT will be increased starting on June 1 with a range of 14" -US\$3.00, 20"/21"-US\$4.00. Although it was difficult to raise the price, due to the tube shortage, the major customers accepted anyway." Chunghwa Picture Tubes, LTD, 29 May 1995, CPT Sales & Marketing Division Visiting Report, CHU00028933 - CHU00028945, at 8934E.
- A "market update" from a 1998 meeting stated that the 15" CDT "price increase is successful, some noises from M.N [I believe this refers to "Mainland" (as in Mainland China)] & Korean customers but manageable". Samsung, 01 August 1998, SDCRT-0086256, SDCRT-0086256 - SDCRT-0087004, at 6685.
- From Customer Contact Report: "After CPT [Chunghwa] and Korea Maker increased the 15" CDT selling price in August, there is no longer any price difference." CPT, Lui, et al., 20 August 1998, Sales Department Customer Contact Report, CHU00028248 - CHU00028249, at 8248E - 8249E.
- Meeting notes referring to CDTs: "Visited HTC/MEC/TSB [Hitachi/Matsushita/Toshiba] and other Taipei branch office personnel, expressed to them the successful price increase." Chunghwa Picture Tubes, LTD, 28 August 1998, Report (submit), CHU00023392 - CHU00023398, at 3394.01E.
- From meeting notes: "Chunghwa: Increased the price of "17 [sic]". Samsung SDI, 04 November 1998, SDCRT-0086441, SDCRT-0086441 - SDCRT-0086442, at 6441E.
- A meeting note referring to a previously planned price increase for 17" CDT stated, "All of the companies successfully increased their prices." Samsung SDI, 18 January 1999, CDT Industry (January 18, '99) Meeting Result, SDCRT-0086557 - SDCRT-0086560, at 6557E.
- Meeting participants reporting on the sales and prices of different sized CDTs: "SDD - Mr. D Y Kim said 1 [circled] Price of 14" [Underlined by hand] in China Mainland has been successfully raised to \$50 [Underlined by hand]; ensuing customer demands are still strong." Chunghwa Picture Tubes, LTD, 23 June 1999, Business Meeting Report, CHU00030787 - CHU00030794, at 0787.02E.
- From meeting notes: "[T]he price of [15"] CDT's increased" and "14" [Bullet] Price increase completed". Samsung Display Device, Philips, 20 August 1999, Top Management Meeting (August 20), SDCRT-0086675 - SDCRT-0086681, at 6677E.
- Meeting notes from 1999 indicated that cartel members successfully raised prices for 14" and 15" CDTs. "In September, the price of 14" was successfully increased ... All makers expressed that the current production and sales volume [for 15" CDTs] are still good and the prices in August had been successfully increased in accordance with the Agreed Price." Chunghwa Picture Tubes, LTD, 20 September 1999, Visitation Report (Submit), CHU00030855 - CHU00030868, at 0855.02E.
- "Mr. Lin emphasized that this year the 17" price has been able to be *keep* at a price no less than \$90 because of the *Glass Meeting*." Chunghwa Picture Tubes, LTD, 13 October 1999, Contact Report, Meeting Topic: CDT Regular Exchange Meeting, CHU00030888 - CHU00030893, at 0889.

¹¹¹ "Market power is the ability to raise price profitably by restricting output." Areeda, Philip E., Hovenkamp, Herbert, et al., 2007, Antitrust Law: An Analysis of Antitrust Principles and Their Application, Volume IIB, Third

notes show the cartel was fully aware of the relationship between decreased output and increased price, with cartel members proclaiming they had successfully increased prices of both CDTs¹¹² and CPTs¹¹³ by reducing capacity and cutting production. Cartel members reported their success in shutting down lines, both temporarily and permanently.¹¹⁴

Edition, Aspen Publishers, at ¶501. “Restricting output” means that the cartel held output below the competitive or but-for level; it does not necessarily mean that output decreases over time.

¹¹² For example, on the CDT side, notes from a October 13, 1999 meeting read: “In order to contribute to the stabilizing of the market price, CPT [Chunghwa] has decreased production of 17" to the utmost degree for quite a long time...Mr. Lin emphasized that this year the 17" price has been able to be keep [sic] at a price no less than \$90 because of the Glass Meeting.” Hsieh, Chun-Mei (Christina), 13 October 1999, Contact Report, Meeting Topic: CDT Regular Exchange Meeting, CHU00030888 - CHU00030893, at 0888.02E-0889.01E. For context, see,

- Notes from a April 14, 1999 meeting: “The price of the 17" CDT which was increased per agreement starting in May will be raised again (around July) after observing the situation...The companies agreed to stop producing 17" CDT's for at least 5 days (25 days of operation).” Samsung SDI, 19 April 1999, Report on the April 14 Management Meeting Results, SDCRT-0086593 - SDCRT-0086596, at 6593E.
- Notes from a May 21, 1999 meeting: “[Bullet] Up to now, the capacity adjustment for 17" CDT's has been proceeding smoothly as a result of cooperation among the companies. [Bullet] In June, 17" CDT production will stop for 5 days (25 operating days) to adjust the actual production volume in order to maintain the price level.” Samsung SDI, May 1999, Report on the CDT management meeting results (May of '99), SDCRT-0086632 - SDCRT-0086633, at 6632E.
- Notes from a July 23, 1999 meeting, “Senior Manager Cheng proposed that the production stoppage period for 17" tubes be at least seven days in August in order to effectively ensure price levels.” Chunghwa Picture Tubes and LTD, 23 July 1999, Visitation Report, Topic: CDT Market Information Exchange and Price/Production Volume Review, CHU00030809 - CHU00030814, at 0810.01E - 0810.02E.

¹¹³ On the CPT side, notes from an October 27, 1999 meeting read: “Price-up trend [of small and medium CPTs] in European & American market thanks to capacity reduction in Asia.” Chunghwa Picture Tubes and LTD, 27 October 1999, Visitation Report, Topic: Exchange of Market Information and Price Review, CHU00030899 - CHU00030903, at 0902E. For context, see:

- Notes from a 26 September 1998 meeting, “In order to stabilize price for this over-supplied market, a simulated adjustment of each maker's Q4 [1998] production volume plan is as follows.” The notes then detail the quantity reductions of 14" and 20"/21" CPTs for each maker. Chunghwa Picture Tubes and LTD, 26 September 1998, Visitation Report, Topic: 14"/20"/21" CPT Supply/Demand and Price Comment Review, CHU00029262 - CHU00029264, at 9264.01E.
- Notes from a 20 May 1999 meeting describe the number of production lines reduced by each maker for 14" and medium-sized CPTs in Q1 1999. Supply and demand forecasts show overcapacity declining as the year progresses. Chunghwa Picture Tubes and LTD, 20 May 1999, Meeting Minutes, Meeting Subject: CPT Top Management Meeting, CHU00029191 - CHU00029194, at 9193E.

¹¹⁴ See, e.g.,

- Meeting notes referring to output restriction at LPD said, “Production capacity's reduction was still progressing according to plan; UK and one production line of Huafei were closed down in 1Q and 2Q respectively.” Chunghwa Picture Tubes, LTD, Undated, Review of CDT Market, CHU00660200 - CHU00660201, at 0200E.
- “Up to now, everybody has been quite cooperative regarding the implementation of reducing working days.” Chunghwa Picture Tubes, LTD, 24 February 1997, Customer Contact Report, Contents Exchange of Opinions Regarding 14" CDT Price, CHU00028763 - CHU00028767, at 8763.01E.

c) Defendants' conduct makes no sense if the cartel was unable to raise prices above the competitive level

The CRT cartel members engaged in costly conduct for over twelve years, committing significant time and resources – conducting regular meetings, monitoring other members' output, and generating and sharing market intelligence all cost money, employees' time, and other corporate resources – to raising prices. In addition to these tangible costs, by participating in an illegal price-fixing scheme, cartel members bore a great deal of risk in the form of potential fines, legal liability, and jail-time for executives if the conspiracy were made public.

If, as is reasonable, one believes that the cartel members and their employees acted rationally, then they would not have engaged in such costly conduct unless the costs were outweighed by the increased profits cartel members accrued as a result of the cartel.¹¹⁵ Absent the conspiracy to raise prices, cartel members would have avoided the costs and risks of the conspiracy entirely. If, despite their best efforts, cartel members had failed to raise prices and therefore profits, then they should have walked away from the conspiracy. The fact that Defendants, led by experienced

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- “Up to now, the capacity adjustment [reductions] for 17" CDT's has been proceeding smoothly as a result of cooperation among the companies.” Samsung SDI, May 1999, Report on the CDT management meeting results (May of '99), SDCRT-0086632 - SDCRT-0086633, at 6632E.
 - “[Heading] 17" Production Control [text] a) Mr. Jerry commented that various makers have coordinated very well on 17" Capacity control in the past three months. In view of the market situation, July's number of non-workdays should be higher than the average number over the April-June period, to demonstrate each maker's commitment to safeguarding the price.” Chunghwa Picture Tubes, LTD, 23 June 1999, Business Meeting Report, CHU00030787 - CHU00030794, at 0791.02E.
 - “Price up trend in European & American market thanks to capacity reduction in Asia.” When asked about this quote, Chih Chun-Liu, VP of Sales at Chunghwa, testified that this is an example of prices increasing due to a reduction in production. Chunghwa Picture Tubes, LTD, 27 October 1999, Visitation Report, Topic: Exchange of Market Information and Price Review, CHU00029171 - CHU00029174, at 9174E. 20 February 2013, Deposition of Chih Chun-Liu, Volume II (Hereinafter “Deposition of Chih Chun-Liu, Vol II, 20 February 2013), at 363:12 - 363:22.
 - In 2000 Chunghwa audited and confirmed that Samsung's Shenzhen plant had shutdown 17" CDT production. Chunghwa Picture Tubes, LTD, 09 April 2000, Visitation Report, CHU00030998, at 998E.
 - A chart shows that Chunghwa and Samsung each planned and shut down five lines, and LPD planned to shut down six lines and actually shut down seven and a half lines. Chunghwa Picture Tubes, LTD, 27 December 2002, Itinerary, CHU00660487 - CHU00660500, at 0495.
 - A chart that describes a two-step shutdown plan has a note that states: “2nd step seems to to [sic] be implemented in advance than previous agreement.” Samsung, 24 February 2005, Itinerary, SDCRT-0091605 - SDCRT-0091615, at 1611.

¹¹⁵ See, e.g.,

- “In deciding whether to violate the antitrust laws, or to engage in conduct that may result in a finding of a violation, a rational firm will aggregate the expected punishments and discount (multiply) them by the probability of their imposition to determine the expected punishment cost for engaging in that conduct.” Posner, Richard, 2001, Antitrust Law, Second Edition, University of Chicago Press: Chicago, at 47.
- “Only if a cartel is expected to raise the price above the noncartel price and keep it high do firms join. If the noncartel price is close to the cartel price, then firms may not believe that joining the cartel is profitable given the legal liability they potentially face from belonging to a cartel.” Carlton, Dennis W. and Jeffrey M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Person Addison Wesley, at 131 and accompanying footnote.

CRT industry executives, continued to actively participate in the cartel for years is strong evidence that their continued participation elicited a benefit at least as large as the cost of participation.¹¹⁶

It might be plausible that cartel members were mistaken in their belief that they had market power, if the cartel had tried to raise prices and failed one or two times or for a short time period, but it is improbable that the cartel attempted the impossible over and over again for over twelve years, risking millions in fines and even jail time, without giving up. Cartel members were the leaders of large companies in a large industry and should be presumed to know, after repeated attempts, whether they had succeeded in raising price. Given the on-going conduct, they must have believed they succeeded.

Cartel members thereby demonstrated their belief that the cartel had market power, for without it, their on-going attempt to raise price would have been irrational: without market power, the cartel would have no effect on price and the firms would simply earn lower profits. Antitrust authorities recognize that conduct that would be irrational in the absence of market power is evidence of the possession of market power.¹¹⁷

2. Defendants had the market power to raise prices

By definition, a cartel must possess market power in order to raise price above the competitive level. Defendants' conduct, testimony, and contemporaneous business documents show that the cartel members recognized that they had market power. There are two very direct limits to a cartel's market power: production by non-cartel firms and new entrants. As the cartel attempts to restrict output and increase price, the resulting increase in profits encourages either non-cartel firms or new firms to increase output.

Based on my analysis described below, I conclude that non-cartel firms and new entrants did not and could not fully offset the cartel's efforts.

a) The cartel's market power was not eliminated by non-cartel members

If a cartel attempts to increase price and a substantial number of its customers are able to avoid the higher price by switching to a lower-priced supplier outside the cartel, then the cartel will be forced to abandon the higher price. For this reason, a cartel must control a substantial share of the market supply in order to raise prices above the competitive level.^{118,119}

¹¹⁶ "Particularly in large industries with significant stakes, the firms involved will ordinarily have a better grasp of industry conditions and of their own ability to succeed in spite of them than will an outsider. Thus, if one sees clear attempts to coordinate or strong evidence that oligopolistic coordination is successful, the better inference is that the mistake lies not with the firms' analysis of conditions but rather with the enforcer's." Kaplow, Louis, 2011, An Economic Approach to Price Fixing, *Antitrust Law Journal*, 77(2), 343-449.

¹¹⁷ "Some conduct benefits actors only if it supports supracompetitive prices. Because such conduct would be irrational for the perfectly competitive firm, its occurrence indicates that the defendant has (or believes it has) some degree of market power." Areeda, Philip E., Hovenkamp, Herbert, et al., 2007, *Antitrust Law: An Analysis of Antitrust Principles and Their Application*, Volume IIB, Third Edition, Aspen Publishers, at ¶520a.

¹¹⁸ Salant, Stephen W., Switzer, Sheldon, et al., May 1983, Losses from Horizontal Merger: The Effects of an Exogenous Change in Industry Structure on Cournot-Nash Equilibrium, *The Quarterly Journal of Economics*, 98(2) pp. 185 - 199.

¹¹⁹ Identifying a relevant antitrust market and computing market shares is an indirect means of assessing market power. The relevant antitrust market includes all products sufficiently substitutable such that a hypothetical

The CRT cartel dominated the supply of CRTs as a whole and CPTs and CDTs separately; see Exhibits 4, 5, and 11 and Section VI.C.1. Cartel members accounted for at least 85% of CPT and CDT sales for years in which I have found reliable data (from 2000 through 2006 for CPT and 1998 through 2006 for CDT).

Moreover, the CRT cartel possessed 89.0% of the capacity to produce CRTs; see Exhibit 12. Therefore, when the cartel restricted output of CRTs, that output reduction could not readily be offset by increased production of CRTs by non-cartel suppliers; non-cartel suppliers had the capacity to produce only about 10% of the CRTs demanded. Because non-cartel suppliers lacked sufficient capacity to significantly increase their market share, they had little reason to maintain low prices in response to cartel members' supra-competitive pricing. Accordingly, non-cartel suppliers acting in their own self-interest would be expected to raise prices above the competitive level along with cartel members.

Sony, the largest non-cartel CRT manufacturer, accounted for a relatively small and declining share of production. Sony's share of global CPT production fell steadily from around 7% in 2000 to under 3% in 2006 and its share of CDT production fell from around 8-10% in the mid-1990s to zero when it exited the market in 2004.¹²⁰

I therefore conclude that the few competitively-supplied CRTs available as alternatives to cartel-supplied CRTs were insufficient to prevent the cartel from raising prices.

b) The cartel's market power was not eliminated by entry

If a cartel is successful in raising prices above the competitive level, the prospect of high profits may induce firms not currently operating in the industry to enter. If these entrants are sufficiently large or numerous and are not co-opted by the cartel, entrants could potentially undercut the cartel's prices and return the industry to a competitive state. Long-term cartel success therefore depends on the ability to prevent economically significant entry or co-opting entrants. Below, I show that during the class period, economic conditions in the CRT industry deterred entry and there was no meaningful entry in the CRT industry.

(1) Barriers to entry deterred entry

monopolist over products in the relevant antitrust market could set prices above the competitive level by a small but significant amount for a non-transitory period of time. This is according to the Department of Justice's "Hypothetical Monopolist Test", sometimes called the "SSNIP (small but significant and non-transitory increase in price) Test". See, e.g.,

- Areeda, Philip E., Hovenkamp, Herbert, et al., 2007, *Antitrust Law: An Analysis of Antitrust Principles and Their Application*, Volume IIB, Third Edition, Aspen Publishers, at ¶532a.
- "The measurement of market shares and market concentration is not an end in itself, but is useful to the extent it illuminates the merger's likely competitive effects." 2010 Merger Guidelines U.S. Department of Justice and Federal Trade Commission, 19 August 2010, 2010 Horizontal Merger Guidelines, at Section 4.

¹²⁰ See, e.g.,

- MT Picture Display, November 2006, Untitled Spreadsheet of CPT and CTV data, MTPD-0416090.
- Samsung, 11 December 2003, Worldwide CDT Manufacturer's Status, SDCRT-0201291.
- DisplaySearch, 07 July 2005, Q2'05 Quarterly Desktop Monitor Shipment and Forecast Report, CHWA00088192 - CHWA00088762, at 8484.

As discussed in Section VI.B.3, barriers to entry deterred entry. Entry into CRT manufacturing required a large capital investment and could take years. Technical knowledge was also important; even incumbent CRT manufacturers experienced difficulties when establishing new production facilities. The cost, time and risk associated with entering the CRT manufacturing industry would tend to discourage entry.

(2) CRT industry conditions deterred entry

As I showed in Section VI.C.2, the CRT industry was characterized by excess capacity and low returns to capital for much of the class period. Such conditions deter entry of new firms into an industry (even if it is cartelized) for multiple reasons. When excess capacity causes producers to earn less than a competitive return on their investments, potential entrants will not make the large investments necessary to participate in the CRT industry.¹²¹ The low rate of return makes entry undesirable because potential entrants can earn higher returns in other industries.

Excess capacity in the CRT industry also deters entry. Even if the cartel's prices are high enough to make entry attractive, the presence of excess capacity makes known to potential entrants that incumbents have the ability to respond quickly with a price war if significant entry is attempted. To a potential entrant, the excess capacity is a credible threat that, even though prices may be high now, if it were to enter the market the existing firms would increase output, causing prices to fall significantly, making the decision to enter unprofitable ex post. When there is excess capacity, then, cartel members can charge prices above the competitive level, sheltered from competition by entrants.¹²²

(3) There was no meaningful entry in the CRT industry

Two new CRT industry participants appeared late in the class period. Videocon acquired all of the capacity of Thomson, a cartel member, in 2004 and 2005.¹²³ This "entry" did not increase total industry capacity, it was merely a change in the ownership of existing capacity. If, as Plaintiffs allege, Videocon took Thomson's place in the cartel,¹²⁴ then the acquisition of

¹²¹ See, e.g.,

- "Entry is not to be expected when established firms are losing money, anticipating a market decline, or carrying large amounts of excess capacity. Nor is entry assured into a market earning only the competitive rate of return." Areeda, Philip E., Hovenkamp, Herbert, et al., 2007, *Antitrust Law: An Analysis of Antitrust Principles and Their Application*, Volume IIB, Third Edition, Aspen Publishers, at 22.
- A standard finance textbook explains that firms will generally only make investments that offer rates of return in excess of their opportunity costs of capital, also known as above-normal returns. Brealey, Richard A., and Stewart C. Myers, 2000, *Principles of Corporate Finance*, Sixth Edition, McGraw-Hill College, at 19.

¹²² See, e.g.,

- Dixit, Avinash, March 1980, *The Role of Investment in Entry-Deterrence*, *The Economic Journal*, Vol. 90, No. 357, 95 - 106.
- Maskin, Eric. S., 1999, *Uncertainty and Entry Deterrence*, *Economic Theory*, Vol. 14, 429-437.

¹²³ Videocon acquired Thomson's plant in Italy in January 2004, and all of Thomson's remaining CRT capacity, located in China, Mexico, and Poland, in July 2005. Thomson Videocon I.F.A. Presentation, PHLP-CRT-005242, at 2-3 and Thomson, 2005, *Thomson Exits Tube Business Ahead of Schedule*, PHLP-CRT-030355 - PHLP-CRT-030372.

¹²⁴ Complaint, at ¶189.

Thomson's production capacity would have had no impact on the cartel's ability to raise prices. There is evidence that after the acquisition, in 2005, a senior Videocon executive shared pricing information and production plans with Samsung in an effort to coordinate output reductions.¹²⁵ Even if Videocon did not participate in the cartel after the acquisition, the sale would have resulted in a relatively small shift in production capacity from within the cartel to a non-cartel member. Thomson's share of CPT production capacity just prior to the acquisition was 8.6%.¹²⁶

Baoma began producing 14" CPTs in China in 2007 with a single production line it acquired from LPD's Barcelona plant.¹²⁷ Operations had ceased on the LPD production line prior to its acquisition by Baoma,¹²⁸ so moving the line to China and placing it in service might be argued to have been an increase in industry capacity. Because Baoma's entry was so small and so late in the class period it had no significant effect on the power of the cartel to raise prices on products purchased by U.S. consumers during the class period. Baoma's capacity was only one million units per year, which was only 3% of 2006 industry production of almost thirty million 14" CPTs.¹²⁹

c) The cartel's market power was not eliminated by LCDs

Prior to the late 1990s, there were no viable alternative technologies to CRTs for either monitors or televisions. Over the succeeding decade, LCD displays largely displaced CRTs in both monitor and television usage.¹³⁰ The change from LCDs to CRTs is illustrated in Exhibits 13 and 14. Worldwide shipments of LCD monitors outstripped CRT monitors during 2004, and LCD TV shipments outstripped CRT TVs in 2008.

The growing popularity of LCD products led to a shrinking market for CRT products but, as I explain below, the CRT cartel members maintained supra-competitive prices throughout the damages period. They were able to do so because few customers' purchase decisions were sensitive to changes in the price of CRT products. If the CRT cartel members tried to reduce their prices to compete with the far more expensive LCD products, they would not have been able to persuade enough additional consumers to buy CRT products to make up for the money they would lose by lower prices. The fact that consumers are not very price-sensitive is

¹²⁵ "Recently, when the newly appointed TOP (Indian) of the former TH [Thomson] Co. was consulted, he mentioned that the former TH Co. (current V [Videocon] Co.) 1. Is selling its inventory at low prices until March of next year and 2. It thinks it would like to reduce its production CAPA by 20% from a current 20 MIL to 16 MIL. S Co. stated that, if each of the companies, S, L, M and V [Samsung, LG, MTPD, and Videocon, respectively], reduces its production by 20% (as of this year), supply would become tight and it would be possible to halt the drop in prices by 7 - 8%. MT Picture Display, 12 December 2005, December 12th Korea Meeting Minutes, MTPD-0410020 - MTPD-0410021, at 0020E.

¹²⁶ MT Picture Display, November 2006, Untitled Spreadsheet of CPT and CTV data, MTPD-0416090.

¹²⁷ March 2007, SDI CRT Line Status, LGE00067202, at tab "CHINA LOCAL".

¹²⁸ MT Picture Display, 04 July 2005, CRT Line Status Jun 05, MTPD-0575968.

¹²⁹ LG Electronics, 06 March 2007, Global C-CRT Line Status, LGE00091909 and MT Picture Display, November 2006, Untitled Spreadsheet of CPT and CTV data, MTPD-0416090.

¹³⁰ Other display technologies were also available in televisions during the class period but were generally not functional substitutes for CRT displays due to size limitations. Alternative display technologies include plasma, and rear projection displays using CRT, LCD, digital light processing (DLP), and liquid crystal on silicon (LCOS). Plasma and rear projection displays are generally larger than the biggest CRT TVs. DisplaySearch, May 2011, Analysis Group, Inc. Custom Data Project, DISP_LCD_000128.

illustrated by the growing popularity of LCD monitors and TVs despite their hefty price premiums over comparably-sized CRT products. While LCD products may have been functionally superior to CRT monitors and TVs, they did not prevent the CRT cartel from imposing cartel overcharges on U.S. end-users of CRT monitors and TVs during the damages period.

(1) Defendants maintained supra-competitive prices despite the encroachment of LCD finished goods

There are two related reasons why the growing popularity of LCD monitors and TVs might cause CRT prices to fall. First, when large numbers of consumers started buying LCD finished goods, they stopped buying CRT finished goods. This secular decline in demand, coupled with excess CRT production capacity, caused the “sick industry problem” discussed in Sections VI.C.2, VI.C.2.a), and VI.C.2.b). Absent collusion, participants in a sick industry are expected to engage in “cutthroat” or “ruinous” competition, in which prices fall so far that suppliers earn less than the competitive rate of return. Second, if the declining prices of LCD finished goods constrained the price that the cartel could charge for CRTs, CRT prices might fall as LCD prices fall.

In fact, CRT prices exhibited remarkable resiliency in the face of LCD encroachment, indicating that the cartel successfully avoided cutthroat competition by collusively maintaining cartel prices and that the prices of CRTs were not constrained by prices of LCD finished goods.

Generally, prices of CDTs and CPTs had been declining since at least 1995, well before the advent of LCD technology; see Exhibits 15 and 16. When consumers began buying significant numbers of LCD monitors around 2001, CDT manufacturers did not respond by accelerating the downward price trend as would be expected if LCDs constrained their prices. Instead, the downward trend in CDT prices slowed. For example, the average price of a 15" CDT in 1995 was \$149, falling to \$46 in 2001 and \$26 in 2007. From 1995 to 2001, the price of a 15" CDT declined by about 18% per year; that downward trend slowed to 9% per year from 2001 to 2007, a period when LCD monitors increased in popularity to dominate monitor sales. See Exhibit 13. This pattern of CDT pricing is evidence that LCD monitors did not constrain the price Defendants charged for CDTs.

CPT prices also exhibited a downward trend in the years before consumers began buying significant numbers of LCD TVs in 2005. For example, the average price of a 20" CPT in 1995 was \$69, falling to \$38 in 2004 and \$32 in 2007. From 1995 to 2004, the price of a 20" CPT declined by about 6% per year; that downward trend was relatively unchanged from 2004 to 2007, the period during which LCD TVs began to supplant CRT TVs. See Exhibit 14.

(2) Defendants recognized the inevitable decline of CRT demand

Defendants’ contemporaneous business documents demonstrate their understanding that CRT demand would decline due to increasing LCD popularity.¹³¹ If the Defendants viewed CRT’s

¹³¹ See, e.g.,

- “Also, the CRT TV market will not be able to prevent an LCD invasion, so expect CRT market demand to continuously decrease.” Samsung SDI, August 2005, Competitor China Visit Report, SDCRT-0091524 - SDCRT-0091530, at 1529E.

competition with LCD as being driven by price, they would have reduced CRT prices to fight the LCD encroachment. But the defendants instead colluded to hold prices steady or reduce prices only slowly, despite the losses to LCD.¹³² This strategy reveals a business judgment that CRT manufacturers could not profitably respond to LCDs by reducing prices: that LCDs are not a price-constraining alternative to CRTs. The defendants also indicated that it was only through mutual cooperation, through their cartel activities, that they could mitigate the decline in CRT prices.¹³³

(3) LCDs are not functional substitutes for CRTs though LCD products are functional substitutes for CRT products

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- “This fiscal year, affected by the replacement by LCD, the CDT market situation has become low.” Chunghwa Picture Tubes, LTD, Undated, [Untitled Document], CHU00624682, at 4682E.
 - “*CDT monitor W/W* [worldwide] demand is decreasing ...” Chunghwa Picture Tubes, LTD, 27 March 2003, Trip Report, CHU00031822 - CHU00031824, at 1822.01E

¹³² See, e.g.,

- “To control the big CDT picture and to avoid accelerated deterioration [in the face of LCD replacement], CPT/LPD/SDI [Chunghwa, LPD, and Samsung] settled: together KEEP the price in the short term to ensure that the 3 makers can KEEP a definite profit.” Chunghwa Picture Tubes, LTD, Undated, [Untitled Document], CHU00624682, at 4682E.
- “[A]ll makers have a common hope for *CDT* prices not to continue to drop in 2003, and to establish a regular contact and communication meeting among each other to strengthen market information exchange and mutual restraint.” Chunghwa Picture Tubes, LTD, 27 March 2003, Trip Report, CHU00031822 - CHU00031824, at 1822.01E.
- “Monitor the circumstances of the LCD price, but maintain the current [CDT] price level for the time being.” Samsung SDI, 28 July 2004, Report of the CDT MTG Result, SDCRT-0090319 - SDCRT-0090321, at 0319E.
- “[Heading] Purpose of Visit ... (3) CDT price maintenance....” Samsung SDI, Lee, Jae In, 03 March 2003, E-mail, Subject: Report on Mitsubishi Meeting Result, SDCRT-0006041, at 6041E.

¹³³ See, e.g.,

- “We are attempting to cooperate closely with CDT. We have prevented a price decline of around the 12% level even though LCD has been attacking us this year. There has been cooperation within the CDT industry through an an [sic] active adjustment of supply depending on changes in demand based on an exchange of information between the actual workers. Also we have held TOP MEETINGS 1 - 2 times a year. ... With LCD, we expect the monitor area will grow by up to 65% this year from [market share] 50% last year. We think that this trend will continue but CDT has been cooperating very closely within the industry.” Samsung SDI, August 2005, Competitor China Visit Report, SDCRT-0091524 - SDCRT-0091530, at 1525 – 1526, 1528E
- “Also, the CRT TV market will not be able to prevent an LCD invasion, so expect CRT market demand to continuously decrease. Cooperation within the industry is critical and is a survival issue. If there is proper cooperation within the industry during the first half of the year, there should not be an inventory issue and we may prevent loss due to a price drop.” Samsung SDI, August 2005, Competitor China Visit Report, SDCRT-0091524 - SDCRT-0091530, at 1528E.
- “Hope with both sides' sufficient communication and no malicious competition, can hold the market price [of 14" CPT] and create a win-win opportunity.” Chunghwa Picture Tubes, LTD, 18 October 2005, Market Contact Report, CHU00040992 - CHU00040993, at 0992E.

Economists describe demand for CRTs as “derived demand”: the final consumer wants the product (CRT) not for its own, intrinsic properties, but because possessing the good is a prerequisite for some other consumption the consumer desires. That is, the final consumer wants to watch television or view the files on her computer. To do either, the consumer needs a display device – a computer monitor or TV. This demand for CRT finished goods in turn leads to derived demand for CRTs by the firms that manufacture CRT monitors and TVs. CRT finished goods manufacturers have no alternative to using CRTs; there is no way to produce a CRT monitor or CRT TV without a CRT.

Final consumer substitution can occur across alternative products that are functional substitutes – a computer user may consider alternative monitor technologies that allow her to view her file contents, or a television viewer may consider alternative TV technologies as long as the set plays his desired shows. This demand substitution is occurring at the end-consumer level, not at the direct purchaser level: a company producing CRT TVs and CRT monitors will demand CRTs – it cannot use alternative display technologies inside its CRT-based products.

(4) Functional substitutes are not necessarily economic substitutes

A functional substitute may constrain the price that a seller can charge or it may not. That is, even if Products A and B perform similar functions, the seller of Product A may be able to charge a supra-competitive price without losing a sufficient share of its customers to Product B so as to make the supra-competitive price unprofitable. In this case, Product B does not constrain the price of Product A to the competitive level. On the other hand, if enough customers respond to supra-competitive pricing of Product A by buying Product B, then the seller(s) of product A will find it unprofitable to charge supra-competitive prices. In this case, Product B is a price-constraining (economic) substitute for Product A.

Consider a more concrete example of functional substitutes that are not price-constraining substitutes. The owner of the only movie theater in a college town observes that her Saturday afternoon matinee showings attract far fewer viewers on weekends when there is a home football game. She notes that tickets to the football game can be purchased online for \$200, whereas her Saturday matinee costs \$10. She tries a promotion, setting the price of matinee tickets at \$5 the weekend of the next home game; she finds the lower price attracted essentially no additional viewers to the matinee. She concludes the football game is not a relevant economic substitute for her pricing decisions, despite the fact it is a functional substitute that affects the level of demand for her product: she cannot sufficiently affect relative prices of the two products to induce prospective consumers of the much more expensive good to instead buy her product.

(5) LCDs are not economic substitutes for CRTs

Now consider the impact of LCDs on the demand for CRTs, given that functionally an LCD monitor or TV substitutes for a CRT monitor or TV. Unless consumers consider LCD finished products an economic substitute for CRT finished goods, then the CRT cartel could maintain supra-competitive CRT prices even as LCD products entered the market. That is, the CRT cartel would eliminate its cartel overcharge in response to growing LCD sales only if the resulting change in the relative prices of LCD and CRT products would keep enough prospective consumers buying CRT products to offset the effect of lower CRT prices on cartel profits.

Like the football tickets in the example above, LCD finished goods were much more expensive than their functional substitutes, CRT finished goods. Broadly, LCD products were at least twice

(and sometimes as much as four times) as expensive as CRT products until about 2005 and remained about 50% or more expensive as of 2007. See Exhibits 17-22. Given these price differences, it is clear that consumers chose to buy LCD monitors and TVs over CRT products for the benefits of LCD technology, including size and weight, rather than on the basis of price.

Because LCD finished goods were so much more expensive than comparable CRT products, a small decline in the price of a CRT would change the relative price of a CRT monitor or TV by an even smaller amount. For example, in 2005, a 20"-21" CRT TV cost about \$150 and the CPT inside the TV cost approximately \$40. A 20" inch LCD TV cost almost \$550.¹³⁴ Suppose the CRT manufacturer reduced the cost of the CPT used in that CRT TV by 5% and that this cost change was fully passed through to the CRT TV price.¹³⁵ The CRT TV price would decline by approximately \$2 from its price. Very few consumers who were willing to pay \$400 more for the LCD TV would change their minds and buy the CRT TV if they would have to pay \$402 more for the LCD TV over the CRT TV.

The large price difference between LCD and CRT products meant that the cartel's overcharge represented a small part of the relative price of LCD and CRT finished goods. For example, I estimate that the cartel overcharge on a 17" CRT monitor in 2002 amounted to \$13.43 in 2002 and the overcharge on a 20"-21" CRT TV in 2004 was \$3.60.¹³⁶ Eliminating these overcharges was unlikely to cause a significant number of prospective consumers of the far more expensive LCD finished goods to buy CRT finished goods. Consumers who had decided to pay a significant premium for an LCD monitor or TV were not likely to switch to a CRT monitor or TV even in the absence of the cartel overcharge. Thus, LCD penetration in the display market gave the CRT manufacturers little incentive to price their products competitively.

(6) Falling LCD prices did not prevent a CRT overcharge

Further evidence that prospective LCD product buyers would not have responded to slight decreases in the price of CRT products can be seen in changing purchase patterns over time. As LCD technology advanced, the prices of LCDs and LCD products declined. Consumers could choose between spending less and less for a given size LCD display or could instead "spend" some of the "savings" from lower prices on a larger display. The data revealed that as the prices of LCD monitors and TVs fell over the class period, consumer demand shifted to larger and larger screens. For example, in 2001, the average price of a 17" LCD monitor was more than \$800 and only 14 % of LCD monitors sold were 17" or larger. See Exhibits 18 and 23. By 2005, the price of a 17" LCD monitor had fallen below \$300 and 84 % of LCD monitors sold were 17" or larger. A similar pattern occurred in the LCD TV market. See Exhibits 20-22 and 24. The fact that consumers "traded up" in size as prices fell suggests the characteristics of monitors and TVs are more important to consumers than price and therefore consumers would not respond

¹³⁴ The prices for the 20" LCDTV and the 20"-21" CRT TV were \$549 and \$157, respectively. DisplaySearch, May 2011, Analysis Group, Inc. Custom Data Project, DISP_LCD_000128.

¹³⁵ Throughout this discussion, I assume a 100% pass-through rate. My conclusions would not be materially affected if pass-through was slightly more or less than 100%. See Section X for my estimation of the magnitude of pass-through in this industry.

¹³⁶ I multiplied the estimated overcharge (see Section IX) by the average price of a 17" CDT in 2002 and by the average price of a 20"-21" CPT in 2004 to obtain the dollar overcharge on these two products at these two points in time.

sufficiently to changes in CRT prices by substituting LCD finished goods to make a CRT price decline profitable.

(7) Consumers would not have substituted LCD finished goods in sufficient numbers to prevent supra-competitive pricing of CRTs

As described above, CRT manufacturers' would charge competitive prices only if lowering the CRT price to competitive levels would have induced a sufficiently large number of consumers to switch from buying LCD products to CRT products. The lower CRT price would mean lower profits per unit for Defendants, and the question is whether enough consumers would switch so that more CRT sales would make up for the lower profits for each sale.

For a given price change, we can estimate the number of consumers that would need to be enticed to substitute between LCD and CRT finished goods in order for it to be profitable for Defendants to eliminate their overcharge. Such a calculation is similar to "critical loss analysis", which economists routinely use to determine whether a merger is likely to increase prices.¹³⁷ By estimating the profit earned on each CRT, I determined the reduction in profit per tube resulting from a given price reduction and, since I know how many tubes were sold, the total reduction in profit. I then calculated how many additional CRTs would need to be sold at the new per-tube profit to compensate for the reduced profits on existing CRT sales.

A key input to the calculation is Defendants' gross profit margin (price minus marginal cost) on each CRT sold. I assume a 40% gross profit margin for the purpose of this analysis, which is higher than the handful of estimates I've seen.¹³⁸ The higher the gross profit margin, the fewer additional sales are necessary to make a price decrease profitable. Another key input to the

¹³⁷ See, e.g.,

- Farrell, Joseph and Carl Shapiro, February 2008, Improving Critical Loss Analysis, The Antitrust Source, Vol. 7, No. 3.
- Coate, Malcolm B. and Jeffrey H. Fischer, October 2006, A Practical Guide to the Hypothetical Monopolist Test for Market Definition, Potomac Papers in Law and Economics 06-01, 1 - 48.

¹³⁸ See, e.g.,

- Hitachi, August 2001, Hitachi Electronic Devices (U.S.A.), Inc., HDP-CRT00057240 - HDP-CRT00057284, at 7247.
- LG.PHILIPS, 16 September 2003, Supervisory Board Meeting, PHLP-CRT-003818 - PHLP-CRT-004240, at 15-16.
- 28 August 2003, CDT Market Review, CHU00031194 - CHU00031201, at 1196.02E.
- Beijing-Matsushita Color CRT Company, 13 February 2006, BMCC-CRT000083813, BMCC-CRT000083813.
- Lehman Brothers, 14 February 2007, Chunghwa Picture Tubes (2475.TW - TWD 6.39) 2-Equal weight, CHU00063266 - CHU00063277, at 3270.
- Samsung, 2007, Electronic File of SDCRT-0216503, SDCRT-0216503.
- Salomon Smith Barney Inc., 22 May 2001, Project Mercury Confidential Information Memorandum, EIN0017699 - EIN0018075.

analysis is the magnitude of the overcharge. For the purpose of these calculations, I assumed an overcharge of 5% for CPTs and a 20% overcharge for CDTs.¹³⁹

Given a 40% gross profit margin and a 5% overcharge, Defendants would need to sell approximately 14% more CPTs at competitive prices to make eliminating a 5% overcharge profitable. See Exhibit 25 for the gain in sales needed to make reducing price by 5% profitable. Given a 40% gross margin and a 20% overcharge, Defendants would need to sell approximately 100% more CDTs in order to profit from eliminating the overcharge. See Exhibit 26.

To provide context for the CRT sales volumes, Exhibits 25 and 26 also include the sales volumes for LCD finished goods. For most of the damages period, the number of additional CRT sales necessary to make eliminating the overcharge profitable is greater than the total number of LCD sold. In other words, even if a 5-20% price cut for CRTs was sufficient to induce all consumers who purchased LCD TVs and monitors to switch to CRT products, that still would not have been enough to make the price cuts profitable for CRT makers.

I conclude that it is implausible that sufficient consumers would have purchased CRTs rather than LCDs to make eliminating the cartel overcharge profitable.

(8) Summary: LCDs did not eliminate the CRT cartel's ability to impose an overcharge

Defendants understood that LCD monitors and TVs would supplant CRT technology. Despite this, they maintained or slowed the pace at which CRT prices had been falling. They were able to do so because LCD monitors and TVs are not economic substitutes for CRT finished goods and did not meaningfully constrain CRT prices.

3. The cartel implemented a comprehensive plan to exercise its market power

Economists have identified a number of practices common to successful cartels.¹⁴⁰ Fixing more than just price (e.g., product quality or contract terms), fixing market shares, and assigning customers to suppliers affords cartel members multiple opportunities to detect non-compliance with the cartel agreement. Fixing capacity is a readily-verifiable means of placing limits on cartel members' ability to cheat. Cheating can be discouraged by cartel members by granting their customers most-favored customer clauses and meeting-competition clauses, which promise customers they will receive at least as low a price as that charged all other customers. Such terms reduce the incentive to cheat by requiring that discounts not be given opportunistically to capture incremental customers while continuing to charge higher prices to other customers, but must be given to all customers.

¹³⁹ As I discuss in Section IX, I estimated a 25.0% overcharge rate for CDTs prior to the investigation of the LCD cartel becoming public; after the LCD investigation became public that falls to 12.3%. For CPTs I estimated overcharges of 9.5% and 3.2%. I used the figures 5% and 20% here because smaller overcharges are conservative for these calculations.

¹⁴⁰ Carlton, Dennis W. and Jeffrey M. Perloff, 2005, *Modern Industrial Organization*, Fourth Edition, Pearson Addison Wesley, at 139, 141-144.

Two prominent cartel scholars found that other practices of successful cartels include developing a hierarchy that includes both top-level executives and working-level members; building trust; using multi-pronged strategies; and learning from experience.¹⁴¹

Next, I compare the practices of the CRT cartel to the practices proven to have been successful for other cartels.

a) The cartel established a hierarchy of meetings

Collusion among members of the cartel began at least as early as February 1995, when LG, Orion, and Samsung met to discuss CPT pricing, production, and sales.¹⁴² Approximately three months later, LG and Chunghwa met “to discuss the background for a CPT CDT price increase, and the price increase range as well as to exchange market information.”¹⁴³ Notes from this meeting also show that communication regarding price increases had occurred or was planned with “all CPT/CDT Makers in Thailand, Malaysia and Singapore”, including Samsung, Thai-CRT, and Toshiba. The information exchanged included current prices, plans for future prices, negotiations with customers, current and planned future capacity, and output.

Over time, such bilateral meetings led to more formal, multilateral meetings of cartel members’ managers called “Glass Meetings”, at which the cartel fixed prices, restricted output and capacity, allocated customers, and shared sensitive information. The Glass Meetings continued at least through February of 2007.¹⁴⁴ Regular attendees of the Glass Meetings included Chunghwa; LG, Philips, and LPD; MTPD; Orion (Daewoo); Samsung SDI; Thai CRT; and Thomson.¹⁴⁵ I listed the employer of attendees at all meetings that were explicitly called “Glass Meetings” in Exhibit 27.

The cartel established a hierarchy of meetings with three levels: Top Management Meetings, Management Meetings, and Working Level Meetings.¹⁴⁶ Top Management Meetings were held

¹⁴¹ Levenstein, Margaret and Valerie Suslow, March 2006, What Determines Cartel Success?, Journal of Economic Literature, Vol. 44., at 43-44, 67.

¹⁴² 14 February 1995, Mid-Long term investment strategy for overseas strategic regions, SDCRT-0086208 - SDCRT-0086210.

¹⁴³ Chunghwa Picture Tubes, LTD, 29 May 1995, CPT Sales & Marketing Division Visiting Report, CHU00028933 - CHU00028945, at 8933.01E.

¹⁴⁴ Glass Meeting on 8 February 2007 attended by Chunghwa, MTPD, SDI, and LPD. Jimmy, Wu, and Meng Ying, February 2007, Market Visitation Report (Glass Meeting), CHU00030437 - CHU00030438, at 0437.01E.

¹⁴⁵ CC Liu, Chunghwa’s vice president of sales, testified to the regular meeting participants. “[Q.] At any period of time, from the period of time 1995 to 2005, when you left Chunghwa, what companies did you meet with at the group meeting? A. Samsung, LG, Philips, Orion, Thai CRT. In the first stage there was one more company that joined the venture of Toshiba and Matsushita... I mentioned LG and Philips separately but for the period you mentioned, from 1995 to 2005, LG and Philips merged in one. The company merged by LG and Philips in 2001 certainly appeared in the later group meetings.” I believe that the “one more company that joined the venture of Toshiba and Matsushita” refers to the joint venture of Toshiba and Matsushita (i.e., MTPD). 19 February 2013, Deposition of Chih Chun-Liu, Volume I (Hereinafter “Deposition of Chih Chun-Liu, Vol. I, 19 February 2013), at 50:1 - 50:17.

¹⁴⁶ See, e.g.,

- “Q. Thank you. You previously talked about how in 1998 David Chang from Philips came up with a method to better structure the glass meetings, and that there was top level CEO meetings and then there were management-level meetings. My question is: were there other working-level meetings that were also

quarterly for much of the class period, trailing off to one to two meetings per year in the later years, and were attended by high-ranking executives such as Presidents, Vice Presidents, and Chief Operating Officers.¹⁴⁷ Chairmanship of the Top Level Meetings was assigned to executives from different cartel members on a rotating basis.¹⁴⁸ The function of Top Level

created by Mr. Chang? [objection omitted] THE WITNESS: There were such working-level meetings, however not regularly. BY MR. SAVERI: Q. How often would the working-level meetings meet? A. That depends on the needs. Normally it will not be too long. Sometimes one meeting a month. Sometimes meeting in two months.” Deposition of Chih Chun-Liu, Vol. I, 19 February 2013, at 73:1 - 73:18.

- A meeting held on 18 January 1999 planned for a Working Level Meeting on February 10 and a Top Meeting on March 5. Samsung SDI, 18 January 1999, CDT Industry (January 18, '99) Meeting Result, SDCRT-0086557 - SDCRT-0086560, at 6559E.
- A meeting held on 14 April 1999 planned for a Management Meeting on May 21 and a Top Meeting on May 25/26. Samsung SDI, 19 April 1999, Report on the April 14 Management Meeting Results, SDCRT-0086593 - SDCRT-0086596, at 6593E-6594E.

¹⁴⁷ See, e.g.,

- “Q. You indicated that there were monthly meetings of the group meetings. Were there monthly meetings of the CEOs from 1997 onwards? [objection omitted] THE WITNESS: The monthly meeting will be attended by people who are heads of the sales for people of sales VP or above. The CEO met about every quarter, every three months, if there were emergent meetings, CEOs could be called to have such urgent meetings every two months or so.” Deposition of Chih Chun-Liu, Vol. I, 19 February 2013, at 53:17 - 54:2.
- “Top meeting: once/quarter.” Samsung SDI, November 1998, CDT Industry (11/28, 29) Meeting Results, SDCRT-0086445 - SDCRT-0086448, at 6445E.
- “Various makers agreed to change, from now on, to hold Top-Management meeting every 2 months and Working Level Meeting every month.” Chunghwa Picture Tubes, LTD, 24 July 2001, Visitation Report (submitted), CHU00036384 - CHU00036385, at 6384.03E.
- “Q. And the top meetings that you attended with J.S. Kim in 2002 and 2003, approximately how often would they occur? [objection omitted] THE WITNESS: I think it occurred – they occurred once every three to six months.” 07 June 2012, Deposition of Samsung SDI 30(b)(6) Witness Jaein Lee, Volume II (Hereinafter “Samsung SDI 30(b)(6) Deposition of Jaein Lee, Vol. II, 07 June 2012”), at 226:8 - 13.
- “[W]e have held TOP MEETINGS 1 - 2 times a year.” Samsung SDI, August 2005, Competitor China Visit Report, SDCRT-0091524 - SDCRT-0091530, at 1525E.
- “General meeting attended by the presidents of the 5 companies: 2nd meeting to be held end of Sept. to continuing [sic] from 1st meeting on July 19.” Samsung SDI, 18 July 1998, 7th CDT Industry Meeting (July 18) Results, SDCRT-0086416 - SDCRT-0086418, at 6418.
- A Top Management Meeting on 28 September 2005 included SDI’s Vice President and Sales Vice President, LPD’s Chief Operating Officer and Sales Vice President, and Chunghwa’s Senior Vice President. Chunghwa Picture Tubes, LTD, 28 September 2005, GSM Top Management Meeting, CHU00014230 - CHU00014231.

¹⁴⁸ See, e.g.,

- A Top Management Meeting notes document stated: “A new chairman was selected [Bullet] Mr. Jim Smith was selected by Philips.” Samsung Display Device, Philips, 20 August 2000, Top Management Meeting (August 20), SDCRT-0086675 - SDCRT-0086681, at 6676E.
- A meeting notes document stated: “It was resolved that the next meeting would be held at [Chunghwa] in Taoyuan (5/22 PM 13:00), SDI will be the chair.” Chunghwa Picture Tubes, LTD, 18 April 2001, Overseas Visitation Report, CHU00024560 - CHU00024568, at 4560E.

Meetings was to reach agreement about cartel policy, such as prices, capacity, and division of the market. Meetings of top executives also occurred on golf courses, in conjunction with Top Level Meetings; these were called Green Meetings.¹⁴⁹ Events such as these for top executives are opportunities for members of the cartel to form personal relationships and build trust between cartel members.¹⁵⁰

Management Meetings were held about once a month, sometimes as frequently as once a week, sometimes every few months.¹⁵¹ The function of Management Meetings was to reach agreement

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- A Top Management Meeting notes document stated: “TV GSM’s [Glass Meeting] chairman will be [Chunghwa] for one year.” Chunghwa Picture Tubes, LTD, 30 April 2003, CPT market Report (Overseas Trip Report), CHU00123742 - CHU00123745, at 3742.02E.
 - A meeting discussion agenda stated: “The 3 company meeting host (Chairman) has changed [pointing finger icon] SDI in ’05 Yr. --> [Chunghwa] in ’06 Yr.” CDT, 13 March 2006, Main Discussion Agenda, SDCRT-0091715 - SDCRT-0091718, at 1717E.

¹⁴⁹ See, e.g.,

- Itinerary and arrangements for a Glass Meeting on 5 March 1999 and a Green Meeting on 6 March 1999. The Glass Meeting is evidently a Top Management Meeting because attendees include presidents and executive vice presidents from Orion, Samsung, Philips, LG, and presumably Chunghwa, who made the arrangements. 04 March 1999, Report (Submitted), CHU00021268 - CHU00021276, at 1269E.
- Itinerary for a Green Meeting held on the morning of 24 February 2005 with a Top Management Meeting scheduled for the same afternoon. Chunghwa Picture Tubes, LTD, 24 February 2005, CHU00661917, CHU00661917 - CHU00661928, at 1917.

¹⁵⁰ See, e.g.,

- “Q. When you say the CEO golfing day, so at the CEO meetings those were preceded with a day of golf and then the meeting? A. Which proceeds first is not fixed. Golfing and dinner are for increasing mutual trust. So normally meeting during the day followed by dinner in the evening and golfing the second day. These were for creating more confidence among participants.” Deposition of Chih Chun-Liu, Vol. I, 19 February 2013, at 75:16-75:2.
- “[I]n order to make friendly contacts and strengthen mutual trust, the makers agreed that every 3-4 weeks they would take turns to host a Green Meeting (only two members from each maker) after the meeting is over.” Chunghwa Picture Tubes, LTD, 09 November 1999, Visitation Report, CHU00030916 - CHU00030918, at 0916.02E.
- Itinerary for a Green Meeting held at Country Height Golf Resort on 6 March 1999 included an “Arrangement of awards for the Golf competition”. 04 March 1999, Report (Submitted), CHU00021268 - CHU00021276, at 1268.01E-1268.02E.

¹⁵¹ See, e.g.,

- “Q. Okay. Did – when those meetings occurred, did they – on the once a month – once a month basis, did those levels of meeting all occur on the same day? In other words, would you have a top management meeting, a management meeting, and a working level meeting all occurring on the same day, that particular day of the month? [objections omitted] THE WITNESS: To my recollection, again it depended on the time period, but initially the management meeting was once a month, and working level meeting was so that we could prepare for the management meeting. So working level meetings were held on the same day as the management meetings or one day before the management meetings. In terms of the top management meetings, it would happen once every six months or a year. It was irregular, and it depended on the schedules of the top people, and it would be adjusted based on that.” Samsung SDI 30(b)(6) Deposition of Jaemin Lee, Vol. I, 06 June 2012, at 32:15-33:10.

about cartel policy such as prices and capacity, exchange market intelligence, and to monitor the implementation of cartel agreements, such as compliance with cartel prices and capacity restrictions. Management Meetings were attended by sales directors and managers.¹⁵² A third level of meetings, Working Level Meetings, were held on a more regular basis, often in order to prepare for Management Meetings.¹⁵³ Working Level Meetings were attended by sales staff and sometimes their supervisors.¹⁵⁴

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- “Meeting on the monitoring of the implementation of the agreement reached among the 5 companies [Bullet] Quantity: Once/month [Bullet] Price: Once/month.” Samsung SDI, 18 July 1998, 7th CDT Industry Meeting (July 18) Results, SDCRT-0086416 - SDCRT-0086418, at 6418E.
 - “Meeting running plan [finger icon] would be changed from current once a month meeting to quarterly or bi-monthly meeting.” CDT, 13 March 2006, Main Discussion Agenda, SDCRT-0091715 - SDCRT-0091718, at 9717E.

¹⁵² See, e.g.,

- A European TV Glass Meeting on 11 November 1999 was attended by a Director and Section Chief from Orion, two Directors from Samsung, and a Department Manager and Representative from LG, among other untitled participants from Philips and Chunghwa. Chunghwa Picture Tubes, LTD, 11 November 1999, Contact Report, Topic: European TV Glass Meeting, CHU00030917 - CHU00030919, at 0917.01E.
- A Glass Meeting on 22 April 2002 was attended by a Manager from SDI, an Assistant Manager from LPD, and a Manager and Assistant Manager from Orion, among other untitled participants from Chunghwa. Samsung SDI, April 2002, GSM Meeting Log in April of 2002, SDCRT-0087743 - SDCRT-0087744, at 7743E.
- A Glass Meeting on 8 September 2003 was attended by two Senior Managers from SDI, two General Managers from LPD, and a General Manager from MTPD, among other untitled participants from Chunghwa. CPT, 08 September 2003, CPT Glass Meeting Result Report, SDCRT-0088732 - SDCRT-0088733, at 8732.

¹⁵³ See, e.g.,

- “Q. Okay. Did – when those meetings occurred, did they – on the once a month – once a month basis, did those levels of meeting all occur on the same day? In other words, would you have a top management meeting, a management meeting, and a working level meeting all occurring on the same day, that particular day of the month? [objections omitted] THE WITNESS: To my recollection, again it depended on the time period, but initially the management meeting was once a month, and working level meeting was so that we could prepare for the management meeting. So working level meetings were held on the same day as the management meetings or one day before the management meetings. In terms of the top management meetings, it would happen once every six months or a year. It was irregular, and it depended on the schedules of the top people, and it would be adjusted based on that.” Samsung SDI 30(b)(6) Deposition of Jaemin Lee, Vol. I, 06 June 2012, at 32:15-33:10.
- “[Chunghwa] suggested that weekly meeting shall be called to review price increase status, all makers agreed and set a Meeting at [Chunghwa] Yang Mei factory on 3/27/97 at 9:30 AM, and setup the following dates for future meetings as follows for the time being: [break] 4/2: PH [Philips] Taipei, 4/9: LG, 4/16: Daewoo 4/23: SDD [Samsung] [break] In order to strengthen communication, ensure price increases to succeed smoothly.” Chunghwa Picture Tubes, LTD, 19 March 1997, Customer Contact Report, Main Contents 14"/15" CDT Price Opinion Exchange, CHU00028749 - CHU00028751, at 8750E.
- “Review of the implementation method of the Working Level weekly meeting: Each maker indicated that because of the success of Glass Meeting, everybody has been Enjoying Business this year. Now that the Slow Season is coming, everybody should continue to strengthen communications and contacts, so the weekly meetings should continue to be held on time. However, in order to make friendly contacts and strengthen mutual trust, the makers agreed that every 3-4 weeks they would take turns to host a Green

Cartel members also met frequently outside of Glass Meetings, in bilateral meetings, on an *ad hoc* basis.¹⁵⁵ Besides meeting in person, they also communicated regularly by phone and fax.¹⁵⁶

Meeting (only two members from each maker) after the meeting is over.” Chunghwa Picture Tubes, LTD, 09 November 1999, Visitation Report, CHU00030916 - CHU00030918, at 0916.02E.

- “Various makers agreed to change, from now on, to hold Top-Management meeting every 2 months and Working Level Meeting every month.” Chunghwa Picture Tubes, LTD, 24 July 2001, Visitation Report (submitted), CHU00036384 - CHU00036385, at 6384.03E.
- “Future GSM [glass meeting] schedule is temporarily set as: a. working level meetings: once quarterly (around the 20th of February, May, August & November) and b. management meeting to be held semi-annually (June and December).” Chunghwa Picture Tubes, LTD, 30 April 2003, CPT market Report (Overseas Trip Report), CHU00123742 - CHU00123745, at 3742.01E.

¹⁵⁴ See, e.g.,

- “Other than to be attended by sales staff for Southeast Asia at the *working level* meetings, the headquarters should also send sales or *marketing* supervisors to attend”. Chunghwa Picture Tubes, LTD, 30 April 2003, CPT market Report (Overseas Trip Report), CHU00123742 - CHU00123745, at 42.01E- 42.02E.
- A Glass Working Meeting held on 15 November 2004 was attended by a Branch Manager and Section Chief from LPD, a Branch Manager and Section Chief from Samsung, and untitled participants from Chunghwa. Samsung SDI, 15 November 2004, Report the results of the Glass working meeting on Nov. 15, SDCRT-0090350 - SDCRT-0090353, at 0350E.

¹⁵⁵ See, e.g.,

- Chunghwa Picture Tubes, LTD, 17 May 1996, Sales & Marketing Division Visiting Report, CHU00028809 - CHU00028810.
- Chunghwa Picture Tubes, LTD, 24 May 1996, Sales & Marketing Division Visiting Report, CHU00028968 - CHU00028969.
- Dr. Sommerfeldt, 19 September 1996, re: Meeting with EMEC, SDCRT-0086217 - SDCRT-0086229.
- Samsung, 09 April 1997, Discussion Report of Meeting with MEC, SDCRT-0086230 - SDCRT-0086255, at 6236E.
- Chunghwa Picture Tubes, LTD, 09 April 1998, Visitation Report, CHU00028642 - CHU00028644.
- Chunghwa Picture Tubes, LTD, 14 April 1998, Visitation Report, CHU00028254 - CHU00028256.
- Chunghwa Picture Tubes, LTD, 28 April 1998, Visitation Report, CHU00028647.
- Canavan, Pat, Johnson, Jeff, 15 July 1998, Subject: Visit to Hitachi, PHLP-CRT-081748 - PHLP-CRT-081750, at 1748E - 1750E.
- Kobayashi, Nobuhiko, 05 April 1999, E-mail, Subject: LG Electronics Business trip report ('99.4.2), HDP-CRT00025934 - HDP-CRT0002593, at 5934.
- Nishiyama, Hirozuka, 09 November 1999, Subject: Hitachi CRT, MTPD-0016566 - MTPD-0016567.
- Oh, Kyung Chul, 03 March 2000, Email, Subject: (Resending) Toshiba Flat CPT Offer Situation, SDCRT-0005813, at 5813E.
- Samsung SDI, 07 June 2000, Meetings, SDCRT-0087324 - SDCRT-0087329, at 7326E.
- Watanabe, Genichi, 24 May 2001, E-mail, Subject: HEDUS 32V Price Competiveness - Mexico is Scary, Korea is Scary, HDP-CRT00049291, at 9291E.
- Chunghwa Picture Tubes, LTD, 06 June 2001, Visitation Report (Submit), CHU00031137.

b) The cartel fixed prices

The cartel agreed to fix prices on numerous occasions.¹⁵⁷ A list of documents demonstrating cartel members' agreements to fix prices is in Exhibit 1. I and my staff identified approximately

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- Chunghwa Picture Tubes, LTD, 26 June 2001, Sales & Marketing Division Visiting Report, CHU00031141.
 - Samsung SDI, 25 October 2001, Toshiba (IN) CPT (Telephone), SDCRT-0087685 - SDCRT-0087686, at 7685E - 7686E.
 - Although the document is primarily about a Glass Meeting, it also reports a meeting between Hitachi and Samsung separate from the Glass Meeting. Samsung SDI, 17 December 2001, GSM Meeting, SDCRT-0087437 - SDCRT-0087440, at 7439E.
 - Phil PJ Lee, 30 May 2002, Information for SDI and Toshiba, PHLP-CRT-014141 - PHLP-CRT-014143.
 - Samsung SDI, 30 July 2002, SDCRT-00877926, SDCRT-0087926 - SDCRT-0087927, at 7926E.
 - Iwamoto, Shinichi, 16 August 2002, E-mail, Subject: FW: Information exchange with Thomson, MTPD-0223790 - MTPD-0223792, at 3790E.
 - Park, Sung Deok, 20 November 2002, E-mail, Subject: Europe Business Trip Report, SDCRT-0006632 - SDCRT-0006633, at 6633E.
 - Samsung SDI, Lee, Jae In, 03 March 2003, E-mail, Subject: Report on Mitsubishi Meeting Result, SDCRT-0006041, at 6041E.

¹⁵⁶ See, e.g.,

- “Director Liu [Chunghwa] made a phone call to [Philips] manager Xiu-Li Lin on the spot and confirmed that [Philips]’ price [to AOC] in February was the same as [Chunghwa], and that the order volume was about thousands of units.” Chunghwa Picture Tubes, LTD, 20 February 1998, Customer Contact Report, CHU00028955 - CHU00028957, at 8956E.
- From Samsung’s meeting notes: “Received other Philips information by fax”. Samsung SDI, 18 January 1999, CDT Industry (January 18, ’99) Meeting Result, SDCRT-0086557 - SDCRT-0086560, at 6560E.
- “In the event that there are any changes to the line operations plans, such changes should be reported to other companies by fax or other means in advance”. Samsung SDI, 19 April 1999, Report on the April 14 Management Meeting Results, SDCRT-0086593 - SDCRT-0086596, at 6593E.
- In an internal e-mail, David Ross of Chunghwa UK states that Leo Mink of Philips called him to confirm production shutdowns and ask for Chunghwa’s cooperation. Ross, David, 03 January 2001, E-mail, RE: CPTUK Off-Days (Production Reduction) Plan, CHU00022696, at 2696.01E.
- From meeting notes: “LPD and TSB [Toshiba] believe that it is not necessary to meet so frequently, therefore, it was everyone’s suggestion that the meeting would be held in the second month of each quarter in order to discuss current quarter situations as well as the next quarter...[Handwritten:] The regular private communications among each other should proceed continuously.” CPT, Yang, Sheng-Jen (S.J.), et al., 21 February 2003, Market Visitation (Glass Meeting) Report (For Submission), CHU00020660, at 0660.02E.
- “No common understanding has been reached whether to reduce prices in the future or not, but it was agreed to increase the number of working level meetings. In the future, any price movement must be communicated by decision makers for prices through meeting or by telephone.” Yun, Ling-Yuan (Yvonne), 01 April 2005, General Sales Department Monitor Products Unit, CHU00005997 - CHU00006001, at 5998E.

¹⁵⁷ Chih Chun-Liu, Vice President of Sales at Chunghwa from 2000 to 2005, testified that cartel members met monthly in order to collectively set the prices they would charge their customers. See, e.g.,

- “Q. And what was the purpose of the group meetings? A. We can start from one-on-one meetings. Because this industry, with the large investment, features radical market changes as well as technology – highly

240 documents related to over 130 meetings during which cartel members agreed to set target prices for one or more CRTs. These meetings spanned most of the class period; the earliest documented meeting that I have found was in May 1995 and the latest in February 2007.¹⁵⁸ The cartel fixed prices for both CPTs and CDTs, including tubes with varying sizes, shapes, finishes, and other characteristics.¹⁵⁹ The cartel fixed prices for tubes made by specific manufacturers,¹⁶⁰ for tubes sold to specific customers,¹⁶¹ and for tubes bought or sold by anybody.¹⁶²

intensive technology. Because this industry features great investments as well as highly sensitive market changes, any particular change would drastically affect the players in the market. None of us would like to see such changes beyond what we could sustain. Right from one-on-one meetings, we hoped to see whether the prices could remain stable in order to keep our businesses and our career and the company's life going on. In order to prevent serious losses, to maintain long-term stability in the industry, the best way is for everyone to maintain a price. The most effective way will be through group meetings." Deposition of Chih Chun-Liu, Vol. I, 19 February 2013, at 50:23 - 51:17.

- "Q. And how was the market for CRTs in 1995, when you formed the group meetings? A. I cannot remember exactly what was the situation, I can only remember that after 1995 the market became better slowly. Q. So the group meetings, which began in 1995, was an effort by those companies to stabilize the market for CRTs? [objections omitted] THE INTERPRETER: The witness said yes. THE WITNESS: Yes." Deposition of Chih Chun-Liu, Vol. I, 19 February 2013, at 51:18 - 52:6.
- "Q. At the monthly group meetings, did you come to an understanding of what prices you would charge customers? [objection omitted] THE WITNESS: That would be the purpose of our meeting. Of course we did it. BY MR. SAVERI: Q. Okay. So, is it your understanding then that you came to an agreement with the participants on the prices to be charged for CRTs during this period of time? [objections omitted] THE WITNESS: Yes." Deposition of Chih Chun-Liu, Vol. I, 19 February 2013, at 55:12 - 56:2.

¹⁵⁸ See, e.g.,

- In May of 1995, LG visited Chunghwa for the explicit purpose of gaining Chunghwa's agreement to a price increase LG and Samsung had discussed. LG reported it was visiting CRT manufacturers in Thailand, Malaysia, and Singapore, having already gotten Toshiba Thailand and Thai CRT to agree (and announce) price increases. Chunghwa Picture Tubes, LTD, 29 May 1995, CPT Sales & Marketing Division Visiting Report, CHU00028933 - CHU00028945, at 8933.01E.
- A Glass Meeting was held on 8 February 2007 with attendees Chunghwa, MTPD, Samsung, and LPD. Jimmy, Wu, and Meng Ying, February 2007, Market Visitation Report (Glass Meeting), CHU00030437 - CHU00030438, at 0437.01E.

¹⁵⁹ See, e.g.,

- Chunghwa Picture Tubes, LTD, 26 September 1998, Visitation Report, Topic: 14"/20"/21" CPT Supply/Demand and Price Comment Review, CHU00029262 - CHU00029264.
- Chunghwa Picture Tubes, LTD, 29 June 2001, Agenda, CHU00660395 - CHU00660407.
- Chunghwa Picture Tubes, LTD, June 2003, CDT Market Report, CHU00660217 - CHU00660220.
- MT Picture Display, 06 May 2004, SML Meeting, MTPD-0580751.

¹⁶⁰ See, e.g.,

- Chunghwa Picture Tubes, LTD, 20 May 1997, Customer Contact Report, Main Content 14"/15" CDT Price Discussion, CHU00028725 - CHU00028727.
- Hsieh, Chun-Mei (Christina), 13 October 1999, Contact Report, Meeting Topic: CDT Regular Exchange Meeting, CHU00030888 - CHU00030893.
- Kim, LJ, 26 January 2001, England0101, SDCRT-0087662 - SDCRT-0087663.

Target prices can be found in the text of meeting notes documents or in formal tables included in these documents. Meeting notes reference agreements to increase price,¹⁶³ to set price differentials,¹⁶⁴ to maintain current prices,¹⁶⁵ or to coordinate price reductions.¹⁶⁶ The notes also show cartel members discussing when to send price increase letters to customers.¹⁶⁷ Target price tables included in meeting documents sometimes show past target prices¹⁶⁸ or future target prices.¹⁶⁹ Tables are also frequently used to present price differentials, either alone¹⁷⁰ or alongside the base target prices.¹⁷¹ In general, target prices can be classified in one of three ways:

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- Samsung SDI, 21 November 2003, Schiphol Meeting, SDCRT-0088635 - SDCRT-00886660.

¹⁶¹ See, e.g.,

- Du, Ching-Yuan (Michael), 28 January 1997, Customer Contact Report, CHU00028768 - CHU00028770.
- Chunghwa Picture Tubes, LTD, 27 October 1999, Visitation Report, Topic: Exchange of Market Information and Price Review, CHU00029171 - CHU00029174.
- Chunghwa Picture Tubes, LTD, 04 January 2002, Visitation Report, CHU00031176.
- 26 September 2005, MTPD-0423645, MTPD-0423645.

¹⁶² See, e.g.

- Chunghwa Picture Tubes, LTD, 12 March 1997, Customer Contact Report, CHU00028758 - CHU00028759.
- Samsung SDI, 06 December 2002, 3 Companies MTG Information (5th) - Result Report, SDCRT-0087934 - SDCRT-0087937.
- Chunghwa Picture Tubes, LTD, April 2004, Time Schedule, CHU00660681 - CHU00660692.
- Samsung SDI, 05 August 2005, CPT Meeting Result Report (August), SDCRT-0091382 - SDCRT-0091383.

¹⁶³ Chunghwa Picture Tubes, LTD, 23 July 2004, Overseas Trip Report, CHU00123393 - CHU00123403, at 3396E.

¹⁶⁴ Samsung SDI, 23 June 1999, Report on the results of the 5 CDT companies' management meeting (June 23), SDCRT-0086641 - SDCRT-0086645, at 6644E.

¹⁶⁵ Chunghwa Picture Tubes, LTD, 07 November 2003, Market Visitation Report (Glass Meeting), CHU00030071 - CHU00030093 at 0073.03E.

¹⁶⁶ Chunghwa Picture Tubes, LTD, 21 December 2001, Visitation Report (Submitted), CHU00036406 - CHU00036407, at 6407E.

¹⁶⁷ Chunghwa Picture Tubes, LTD, 10 May 1999, Business Meeting Report, CHU00036378 - CHU00036380, at 6378.01E.

¹⁶⁸ Samsung SDI, 25 April 2003, Glass Result Report, SDCRT-0088713 - SDCRT-0088714, at 8714E.

¹⁶⁹ Chunghwa Picture Tubes, LTD, 01 October 1998, VISITATION REPORT, CHU00030670 - CHU00030674, at 0673.02E – 0674.01E.

¹⁷⁰ Chunghwa Picture Tubes, LTD, 25 March 2004, Return-from-Abroad Trip Report, CHU00031240 - CHU00031247, at 1240.

¹⁷¹ Chunghwa Picture Tubes, LTD, 29 April 2005, Market Visitation Report (Glass Meeting), CHU00030497 - CHU00030498 at 0498E.

a maintenance price (i.e., keep at current \$X),¹⁷² a bottom price (i.e., do not charge below \$X),¹⁷³ or a guideline price (i.e., charge \$X).¹⁷⁴

Defendants' contemporaneous business documents suggest the cartel members did not always raise prices to the full extent that they had agreed upon.¹⁷⁵ As described in Section VII, some "cheating" on the cartel's agreed-upon pricing does not in itself indicate that the observed prices are competitive. In fact, some cheating may be expected and part of the normal functioning of a successful cartel.¹⁷⁶ A cartel member may set its price below the target price but above the competitive price, thereby harming the direct purchaser.

c) The cartel imposed output and capacity restrictions

The cartel agreed to restrict CRT output and capacity on numerous occasions. Exhibit 28 lists dozens of meetings during which cartel members agreed to reduce output and/or capacity. Many of these agreements applied to CDT production, although there were at least ten instances in which cartel members agreed to reduce output or capacity of CPTs. During the early years of the class period, these agreements were for the temporary shutdown of particular production lines for a fixed period of time; the effect of temporarily shutting down production lines was to reduce output during the time lines were not operating, thereby raising price.¹⁷⁷

¹⁷² Chunghwa Picture Tubes, LTD, 08 September 2003, CPT Glass Meeting Result Report, SDCRT-0088732 - SDCRT-0088733, at 3.

¹⁷³ Chunghwa Picture Tubes, LTD, 12 March 1997, Customer Contact Report, CHU00028758 - CHU00028759, at 8759E.

¹⁷⁴ Samsung SDI, 25 April 2003, Glass Result Report, SDCRT-0088713 - SDCRT-0088714, at 8714E.

¹⁷⁵ For example, "During 2000 with the help of the GSM [glass meetings] meetings the average 14" CRT price has risen to between \$38 and \$39 delivered. With certain customers we have not followed the GSM [Glass Meeting] rules fully and we do rebate Philips BGTV and Vestel, two of Europe's biggest TV makers." Ross, David, 12 January 2001, EU Pricing, CHU00022700 at 2700.01E.

¹⁷⁶ "Thus, we demonstrate that deliberate and unpunished price cuts and business stealing (which would appear to observers as 'cheating') can be critical to the healthy functioning of a cartel." Bernheim, B. Douglas and Madson, Erik, March 2014, Price Cutting and Business Stealing in Imperfect Cartels, NBER Working Paper Series 19993, at 6.

¹⁷⁷ See, e.g.,

- Meeting notes have attached production control tables: "3. Respective makers to reduce production days in order to control output quantity. [break] 4. In order to maintain original M/S [market share] as a principle, respective makers must not use the opportunity to acquire original delivery volume of other makers due to price increase. [break] Remark: SDD [Samsung] provided production control table for all makers is hereby copied, revised and attached as an appendix." Table contains worldwide CDT production volumes. Chunghwa Picture Tubes, LTD, 25 February 1997, Customer Contact Report, CHU00028760 - CHU00028766, at 8760.02E - 8762E.
- "Reached an agreement to reduce the production of 17" CDT [Bullet] Factory operation to be adjusted first to stabilize the price [Arrow] 3/4 quarter capacity: 5.5 million units, actual production: agreed to reduce to 3.9 million units, reached a 25% prod. reduction. [Bullet] Also, companies agreed to reduce production by further 4% in order to maintain the price 17" screens at US\$ 93." Samsung SDI, 31 July 1998, 8th CDT Industry Meeting (July 31) Results, SDCRT-0086419 - SDCRT-0086420, at 6419E.
- "[Bullet] Up to now, the capacity adjustment for 17" CDT's has been proceeding smoothly as a result of cooperation among the companies. [Bullet] In June, 17" CDT production will stop for 5 days (25 operating days) to adjust the actual production volume in order to maintain the price level." Samsung SDI, May 1999,

Over the period 2001-2005, the cartel agreed to specific reductions in production capacity, going beyond their earlier practice of agreeing to specified numbers of idle days per month and agreeing to long-term shutdowns of production lines. The agreed capacity reductions were substantially implemented; see Exhibit 29.

The effect of long-term and permanent shutdowns of lines was to reduce cartel members' ability to produce output, which raised price and reduced cartel members' ability to cheat on cartel prices and output. The cartel was explicit that the motivation for the agreed capacity reductions was to increase price.¹⁷⁸

d) The cartel shared plans and information

Cartel members shared a wealth of information with each other relevant to the business of price fixing. They shared projections of demand,¹⁷⁹ current capacity,¹⁸⁰ projected capacity,¹⁸¹ and

Report on the CDT management meeting results (May of '99), SDCRT-0086632 - SDCRT-0086633, at 6632E.

- "(E) Working Day Reduction: Nov '00 Resolution: [para.] The market demand in November is worse compared to October, in order to maintain the stability of pricing, a stricter control of the output volume is needed. Thus, the shutdown days for 15"/17" production line should be increased to 9 days from 7 days in October." Chunghwa Picture Tubes, LTD, 25 October 2000, Visit Report, CHU00031075 - CHU00031087, at 1076.01E.
- "In order to maintain pricing of 13V in Europe, and to smooth out the 20V price increase implemented by PH/SDI [Philips/Samsung], PH proposed to have each of the 13 V manufacturers reduce workdays in 1Q in order to control inventory. PH (Spain plant) has decided to change the 7 days per week production to be closed on every weekend to hold off production. PH is also requesting [Chunghwa] and Orion to decrease production simultaneously and inform them of the dates when productions are to be held-off...While the pricing of 13V is not out of control yet in Europe, shall we accommodate the PH's request and provide them with the dates of planned production reduction (in principle, we will hold off production for same amount of days as PH)." Ross, David, 03 January 2001, E-mail, RE: CPTUK Off-Days (Production Reduction) Plan, CHU00022696, at 2696.01E.
- "(E) Line Stoppage Days for April Each maker reported on the number of days of downtime planned: [Chunghwa] - 14 days, Philips - 14 days, LG - 14 days, and SDI [Samsung] - 12 days. The final resolution is to have 14 days of downtime for the month of April. As for Orion, it still needs further confirmation before giving a reply." Chunghwa Picture Tubes, LTD, 19 March 2001, Visitation Report (Submit), CHU00031111 - CHU00031112, at 1112.02E.

¹⁷⁸ See, e.g.,

- June 2001: "to effectively decrease capacity and control prices". Chunghwa Picture Tubes, LTD, 27 June 2001, Visitation Report, CHU00660306 - CHU00660311, at 0309E - 3010E.
- July 2001: "The goal is ... to prevent price drops caused by oversupply." Tomoyuki Kawano, 04 July 2001, E-mail, Re: Taiwan Competitor Bulletin (Destroy After Reading), TSB-CRT-00035348 - TSB-CRT-00035349, at 5349E.
- December 2002: "How to Keep the Price [first bullet] 20% capacity shutdown of 3 makers". Chunghwa Picture Tubes, LTD, 27 December 2002, Itinerary, CHU00660487 - CHU00660500, at 0497.

¹⁷⁹ See, e.g.,

- A Contact Report between Samsung and Chunghwa includes a global CDT demand projection of 87.2 million in 1998. Chunghwa Picture Tubes, LTD, 11 November 1997, Customer Contact Report, CHU00028685 - CHU00028686, at 8686E.

- From meeting notes: “The demand for small/medium sizes [of CPTs] in Europe and the U.S. is pretty good but customers said it will become soft from October and it will drop 20% from November. The demand in Asia Pacific Region will remain strong until year end. However those customers who are the large-scale OEM orders, demand is expected to drop starting in November. Currently the delivery of 14" tubes is tighter than 20"/21" and based on current Q4 overall customer order prediction and output estimates (more holidays during year-end for Malaysia's New Year/Christmas).” Chunghwa Picture Tubes, LTD, 22 August 2000, Visitation Report, Topic: Market Information Exchange and Price Review, CHU00029105 - CHU00029107, at 9107.01E.
- From meeting notes: “There is no unanimity on views of market demand among the makers. The final conclusion: according to the latest report in March from IDC, Desktop PC still has 8.7% growth in '01 when compared to '00, therefore, CDT demand is optimistically forecast to reach 118 Mpcs. However, the overall demand is in a slump, especially when recession continues in the U.S. market and has yet to see any sign of improvement in Q2. So the CDT demand for the entire year is pessimistically forecast at only 114 Mpcs.” Chunghwa Picture Tubes, LTD, 19 March 2001, Visitation Report (Submit), CHU00031111 - CHU00031112, at 1112.02E.
- A meeting report shows an LPD and Toshiba global demand forecast of 165 million CPTs in 2002 and a Samsung forecast of 156 million CPTs. Samsung SDI, 06 December 2002, 3 Companies MTG Information (5th) - Result Report, SDCRT-0087934 - SDCRT-0087937, at 7936E.
- A Glass Meeting report shows a forecast of CDT demand in the second half of 2005. Samsung SDI, 04 July 2005, G/S MTG Result Report, SDCRT-0091656 - SDCRT-0091659, at 1658E.

¹⁸⁰ See, e.g.,

- Meeting notes include CDT and CPT capacity information for SDD, LG, and Orion. CPT, 17 March 1995, 3/17 - 3/18 CRT Manufacturers Meeting, CHU00028565 - CHU00028566, at 8565E - 8566E.
- Meeting notes include CPT capacity information for Chunghwa, LG, Orion, Samsung, Thai-CRT, and Toshiba in 1st and 2nd Quarter 1999. 07 March 1999, Malay Meeting on Mar 07, CHU00029248 - CHU00029258, at 9253.
- A Glass Meeting presentation includes CPT capacity information for Samsung, LPD, Chunghwa, and Orion in 2nd Quarter and 3rd Quarter 2002. 28 May 2002, Glass Meeting, SDCRT-0007588 - SDCRT-0007594, at 7590-7591.
- A Glass Meeting report includes CPT capacity information for MTPD, Samsung, LPD, Thai-CRT, and Chunghwa in 2nd Quarter and 3rd Quarter 2004. Chunghwa Picture Tubes, LTD, 18 May 2004, Market Visitation Report (Glass Meeting), CHU00124024 - CHU00124031, at 4024.01E.
- A meeting agenda includes current CDT capacity for Samsung, LPD, and Chunghwa. Samsung SDI, 13 March 2006, Main Discussion Agenda, SDCRT-0091715 - SDCRT-0091718, at 1716E.

¹⁸¹ See, e.g.,

- Notes from a 1999 meeting include projected small and medium CPT capacity for Chunghwa, LG, Orion, Samsung, Thai-CRT, and Toshiba in 1st Quarter 2000. Chunghwa Picture Tubes, LTD, 21 September 1999, Visitation Report, CHU00029175 - CHU00029178, at 9177E.
- A 1999 Glass Meeting presentation includes projected CDT capacity information for Chunghwa, LG, Orion, Philips, and Samsung in the year 2000. Chunghwa Picture Tubes, LTD, 20 September 1999, Visitation Report (Submit), CHU00030855 - CHU00030868, at 0863E.
- Meeting notes include forecasted capacity changes for Philips, Thomson, Samsung Germany, and Daewoo. Kim, Lak Jin, 17 May 2001, Meeting Result Report, SDCRT-0087667 - SDCRT-0087669, at 7668E.
- A 2002 Top Meeting presentation includes projected CDT capacity information for 2003, assuming line shutdowns at Sony and Toshiba and after a 20% shutdown of lines at Chunghwa, LPD, and Samsung. November 2002, Itinerary, CHU00660501 - CHU00660514, at 0506-0508.

projections of excess supply.¹⁸² Identifying situations where excess supply was expected helped the cartel to anticipate conditions in which price erosion was likely to occur, and to prepare for those conditions. For example, if the cartel expected excess supply, it could prepare by shutting down production lines to prevent price from falling. See Sections VIII.A.1.b) and VIII.A.3.c).

Cartel members also shared information with each other regarding their negotiations with customers, including the names of customers to whom they were selling and with whom they were in negotiations, the products they were selling, their quantities, and their prices.¹⁸³

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- Notes from a 2002 meeting include projected capacity for 14", 20", and 21" CPTs in 1st Quarter 2003 for Chunghwa, Thai-CRT, Toshiba, Samsung, and LPD, as well as projected global capacity for each quarter of 2003. Chunghwa Picture Tubes, LTD, 17 December 2002, Market Visitation Report, CHU00030559 - CHU00030562, at 0559.01E.

¹⁸² See, e.g.,

- In a section titled "Opinion Exchange regarding '95/'96 W/W [Worldwide] CDT Supply/Demand" from a Contact Report between Samsung and Chunghwa: "Both sides reached a common understanding with regard to supply exceeding demand starting in the second half of 1996 (especially for 17")." Chunghwa Picture Tubes, LTD, 18 September 1995, Customer Contact Report, CHU00028865 - CHU00028867, at 8866E.
- A Contact Report between Samsung and Chunghwa includes a global CDT supply and demand forecast which predicts a 21% oversupply situation in 1997 and a 13% oversupply situation in 1998. Chunghwa Picture Tubes, LTD, 11 November 1997, Customer Contact Report, CHU00028685 - CHU00028686, at 8686E.
- Glass Meeting materials from 1999 contain a supply-demand comparison for 2000 based on Philips' demand forecast. Global CDT capacity is 149,428,000 while global CDT demand is 105,300,000, which represents an oversupply of 42%. Chunghwa Picture Tubes, LTD, 20 September 1999, Visitation Report (Submit), CHU00030855 - CHU00030868, at 8865E.
- A presentation from a 2002 Top Meeting has a capacity scenario page which shows a CDT oversupply situation of 22% in 2002 and 28% in 2003. November 2002, Itinerary, CHU00660501 - CHU00660514, at 0506-0507.
- "In the long run, the market will still be oversupplied as a result of the shrinking demands for small sizes [of CPTs]." Chunghwa Picture Tubes, LTD, 25 May 2006, Visitation Report, CHU00036398 - CHU00036401, at 6498.02E.

¹⁸³ See, e.g.,

- Meeting notes show Chunghwa and Samsung compared current 14" and 15" CDT selling price for specific customers (e.g., ACER, ADI, Lite-on). Samsung also shared its October sales volume. Chunghwa Picture Tubes, LTD, 30 October 1997, Customer Contact Report, Main Content 14"/15" CDT Price Discussion, CHU00028687 - CHU00028688, at 8688E.
- Meeting notes from a Europe Glass Meeting include a 14" CPT price comparison (current and planned) of Philips, Chunghwa, Orion, and Samsung regarding specific customers (e.g., MIVAR, Matsushita), as well as sales information (e.g., Philips supplying 20K to Vestel in 2000). Samsung SDI, 11 November 1999, Europe Glass Meeting, SDCRT-0086512 - SDCRT-0086513, at 6512E-6513E.
- Meeting notes include a sales forecast for Philips, Thomson, Daewoo, and Samsung Germany in May 2001 by specific customer, as well as a review of prices by product (e.g., Philips 21" CPT) and specific customer (e.g., BEKO, Sanyo, and MIVAR). Kim, Lak Jin, 17 May 2001, Meeting Result Report, SDCRT-0087667 - SDCRT-0087669, at 1-2.
- Glass Meeting notes include the second quarter 2004 sales of MTPD, Samsung, LPD, Thai-CRT, and Chunghwa, as well as a review of their current 14" CPT prices to specific customers (e.g., Funai, JVC,

Cartel members shared information regarding their plans for the introduction of new products.¹⁸⁴

Cartel members found that the exchange of information reduced competition.¹⁸⁵

Sanyo) and their future asking prices. Chunghwa Picture Tubes, LTD, 18 June 2004, Marketing Visitation Report (Glass Meeting), CHU00030526 - CHU00030529, at 0526.01E-0528.01E.

- A meeting presentation includes CDT sales of Chunghwa, LPD, and Samsung for first quarter 2005, as well as price information for specific customers (e.g., Samsung, LGE, AOC) by supplier. Samsung, 26 April 2005, Agenda, SDCRT-0091634 - SDCRT-0091639, at 1635-1638.

¹⁸⁴ See, e.g.,

- From meeting notes between Chunghwa and Philips: “After the meeting, Jim talked to me alone and expressed that the expectation for next year’s market is not as good as for this year but the [Chunghwa] production, on the contrary, will increase from 3M this year to 4 M, which will cause big impact on the market. Accordingly, he hoped [Chunghwa] could have a second thought. I said that [Chunghwa] didn’t intend to disturb the market and it is a sincere gesture to limit itself from taking orders from customers which have conflicting interests or to inform PH [Philips] first before taking orders. Besides, the growth in quantity this year is mostly from [Chunghwa’s] original own customers and [Chunghwa] didn’t fight for orders viciously against PH. Next year, [Chunghwa] will introduce 15" flat tube but the impact should not be too big. Jim still hopes [Chunghwa] can control the production quantity.” Chunghwa Picture Tubes, LTD, 23 June 2000, Visitation Report, Topic: TV Tube Market, CHU00029110 - CHU00029115, at 9112.01E.
- A meeting notes document talks about the schedule for each company’s introduction of 21" PF (pure flat, with an iron mask) in 2004 and 2005, which has been led by MTPD. MT Picture Display, 17 September 2004, CRT Industry Meeting, MTPD-0580795, at 0795.
- From meeting notes between LPD and MTPD: “Both the parties have exchanged CRT product roadmaps including information of slim tubes of LPD and D-com, D-sup concepts of MTPD.” Engelsen, Daniel den, Brouwer, Wim, et al., 06 December 2004, Visit Report to MTPD in Takatsuki, PHLP-CRT-027718 - PHLP-CRT-027721, at 7720.
- From meeting notes between Chunghwa and Thai-CRT: “Therefore, Thai CRT was aggressively developing 15"RF [real flat]. Although the plan is to have mass production after Q3, it was quoting low prices everywhere. From what we have heard, it has quoted Usd 28.0 to our main customer Orion [Underlined by hand], increasing the pressure on us to drop price with Orion. Therefore, we must accelerate speed in bringing out our 15"RF A/K tube so that we can maintain and strive for orders with the support of competitiveness in cost.” Chunghwa Picture Tubes, LTD, 27 May 2005, Foreign Business Trip Report, CHU00732798 - CHU00732899, at 2899.01E-2899.02E.
- From Glass Meeting notes: “Both SDI (C) [Samsung China] and BMCC projected to mass produce 21" super slim [Underlined by hand] in October this year; LPD(I) [LPD Indonesia] [Underlined by hand] also projected mass production in Q1 next year.” Chen, Hwang-Yun (Henry), Chen, Mu-Lin (Jimmy), 22 September 2005, Market Visitation Report (Glass Meeting), CHU00030472 - CHU00030473, at 0473.01E.

¹⁸⁵ See, e.g.,

- “Q. Based on your background and experience, did you find the one-on-one meetings helpful in avoiding vicious competition? [objections omitted] THE WITNESS: Sometimes. BY MR. VARANINI: Q. And with respect to the glass meetings themselves, I believe you testified earlier that you exchanged demand and supply information; is that correct? [objection omitted] THE WITNESS: Correct. BY MR. VARANINI: Q. And was that also helpful in avoiding vicious competition? [objection omitted] THE WITNESS: Correct.” 26 February 2013, Deposition of Sheng-Jen Yang, Volume III (Hereinafter “Deposition of Sheng-Jen Yang, Vol. III, 26 February 2013”), at 391:4 - 391:22.
- “Q. Did you use the competitor information in the creation of both the sales and the business plans? A. I did use it as – I did refer to it when conducting the supply and demand analysis but I did not use it directly.

e) The cartel established monitoring and enforcement procedures

The cartel monitored compliance with temporary line shutdowns by sending representatives of the cartel on site visits to verify that production had halted.¹⁸⁶ Defendants provided the names of

Q. And did you use the supply and demand analysis in both the sales plans you created and the business plans that you created? A. Yes.” Hitachi 30(b)(6) Deposition of Nobuhiko Kobayashi, Vol. I, 17 July 2012, at 96:16 - 96:24.

- “Q. In addition to exchanging CRT price information, was production information exchanged? A. Yes, that is what I recall. Q. Was capacity information exchanged? A. Yes, that is what I recall. Q. What was the purpose of this information exchange with Toshiba? [objection omitted] THE WITNESS: As I said earlier, this was done. I used this in order to gain a deeper understanding of the CRT industry, the market... Q. Would the combination of all of this information that you would receive, this market information, the type that was being exchanged between you and Toshiba and you and Hitachi, would that help you make business decisions in terms of CRTs? [objections omitted] THE WITNESS: I think I said this earlier as well, but the information from Toshiba was one piece of information. And I gained – I received information from a lot of different sources, from suppliers, customers, research companies, et cetera, et cetera, and so this was but one of them.” 05 March 2013, Deposition of Hirokazu Nishiyama, Volume I (Hereinafter “Deposition of Hirokazu Nishiyama, Vol. I, 05 March 2013”), at 169:19 - 173:2.
- “Q. What was the purpose of exchanging North American CRT production information with Thomson in this 2002 to ’06 time period we talked about this morning? [objection omitted] THE WITNESS: One of the objectives was that I wanted to know what the production capacity for each of the North American CRT plants were. BY MR. LAMBRINOS: Q. Why did you want to know that? A. If it’s possible to get a sense of the overall capacity since the demand has been – since we were informed of the demand by the customers, it would be possible to see the relationship between supply and demand. Q. When you see the relationship between supply and demand, how does that help you run your CRT business? [objection omitted] THE WITNESS: First, it would be possible to get a sense of what type of demand there is in the market when introducing a new product. BY MR. LAMBRINOS: Q. Second? A. Second, it’s also possible to make a projection of how the CRT prices would move in general by understanding the relationship between the supply and the demand.” 07 February 2013, Deposition of Shinichi Iwamoto, Volume I (Hereinafter “Deposition of Shinichi Iwamoto, Vol. I, 07 February 2013”), at 69:13 - 70:15.
- “THE WITNESS: After 1995, almost all the CEOs of all the CRT manufacturers began to meet regularly. Regarding the price it was discussed regarding how much for a certain model and how to price that. However, whether a price can remain stable or not depends more on the demand and supply situations. David Chang came up with something more efficient because we believed that the market and the supply situations should be addressed with the emphasis in order to keep the price. In that case every one of us would have strong confidence to know the market situations and changes in demand and the supplies. If there is an over-supply then we will discuss, ‘What shall we do?’ If there was a shortage then we can raise the price. If we could more accurately understand the market trends, we will have greater confidence in the situations, for instance to raise the price. In order to fully obtain the information and the figures, we then had job divisions, unlike before people just chat on top of their head. The Chairman was thus elected to assign jobs that you should provide this information and the others should provide another information so that the demand and supply market situations will be more accurately depicted.” Deposition of Chih Chun-Liu, Vol. I, 19 February 2013, at 52:18 - 53:15.

¹⁸⁶ See, e.g.,

- Notes from a management meeting detail the monitoring of Samsung’s Busan and Suwon factories by Chunghwa and Orion and the monitoring of Chunghwa’s Malaysian factory by Samsung. Samsung’s instructions for its inspectors are: “It should be confirmed whether the #5 line is operating. The line should be checked twice, in the morning and in the afternoon. Please transmit the monitoring results via Single.” The notes also indicate that Chunghwa and Orion monitored LG’s Gumi and Changwon factories for nonoperation on April 17 and 18, and LG monitored Orion’s factory for nonoperation on April 18. Samsung SDI, 19 April 1999, Report on the April 14 Management Meeting Results, SDCRT-0086593 - SDCRT-0086596, at 6596E.

the auditors they intended to send to other companies at meetings, and designated “principal” and “supporting” auditors for each company.¹⁸⁷ Cartel members also created “audit plans” and submitted them to the cartel.¹⁸⁸

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- From CDT meeting notes: “Results of the monitoring of Philips’ Dapon factory [list format] 1) Date: June 24, ’99 [...] 2) Item: #5 line in the Dapon factory [...] 3) Result: #1, 19”, #5 17” lines not operating.” Samsung SDI, 23 June 1999, Report on the results of the 5 CDT companies’ management meeting (June 23), SDCRT-0086641 - SDCRT-0086645, at 6643E.
 - Report meeting notes document: “1. The purpose of this trip is to AUDIT LINE 2 at SSDD’s [Shenzhen Samsung Display Devices] Shenzhen factory to see if it has shut down 17”CDT production according to agreement. [...] 3. After obtaining permission from SSDD, I CHECKed [sic] their production line on 4/9 and 4/10, its original tube, coating, sealing, exhaust gas, ITC, etc. manufacturing process and found that LINE#2 only produced 14” CDT.” Chunghwa Picture Tubes, LTD, 09 April 2000, Visitation Report, CHU00030998, at 0998E.
 - From CDT meeting notes: “(A) Follow-up of last meeting: Audit Control: [Chunghwa] reflected the Audit of the shutdown situation on 10/8 in LG Wales factory, [Chunghwa] people found that LG had not implemented shutdown according to the original plan. Mr. Choi of LG replied that they will investigate and respond, but LG has shut down for over 8 days due to the bad order condition this month.” Chunghwa Picture Tubes, LTD, 25 October 2000, Visit Report, CHU00031075 - CHU00031102.

¹⁸⁷ See, e.g.,

- From a meeting document and handwritten notes: “Auditor names from [Chunghwa], LPD, SDI (Bruce Lu, Eddie MEI from [Chunghwa]; JH Oh, JS Kim from LPD; Jay Jeong and JH Choi from SDI).” Samsung, 21 October 2004, SDCRT-0090233, SDCRT-0090233, at 122.
- An e-mail from JK Cesar Jung, Key Account Manager at LG.Philips Displays, discusses a meeting where auditors would be selected to check on production line shutdowns: “Dears, [...] As already informed, the meeting will be held on [sic] 2 pm ~ tomorrow. The following will be discussed [...] 2. Line shut-down [bullet] prepare the name list of the auditor (2 people) [bullet] relevant audit will be arranged as of Dec/end.” Song, Inhwan, 28 December 2004, E-mail, Subject: Fwd: RE: [Dec 29th] Working level meeting -----> from 15:30, CHU00735283 - CHU00735286, at 5284.
- A meeting notes document contains a table of auditor names by company as well as another table indicating which cartel members were “principal” and “supporter” inspectors for each manufacturing plant. Chunghwa Picture Tubes, LTD, 29 December 2004, Sales Headquarters Display products Sales Department CDT Market Report, CHU00126131 - CHU00126136, at 6132E-6133E.
- In a capacity control discussion from meeting notes: “They agreed to a Line Audit by 2 people having Free Pass, without prior notice at each company.” Samsung SDI, 19 January 2005, G/S MTG Result Report, SDCRT-0091599 - SDCRT-0091604, at 1602E.

¹⁸⁸ See, e.g.,

- Meeting notes have a production control and auditing plan for the 17” CMT [CDT] in May 1999 for Chunghwa, SDD, LG, Orion, and Philips. Chunghwa Picture Tubes, LTD, 12 May 1999, Contact Report, CHU00030757 - CHU00030762, at 0762E.
- “Ultimately, a resolution was reached by everyone that a minimum of seven days stoppage will be implemented in August. In addition, as for LG’s combined line of 15” and 17”, meeting attendees all expressed objections that as production days of 15” can be converted as 17” stoppage days, LG was asked to review and make improvement. Meeting attendees resolved that each company shall report its production stoppage and Audit plans on the weekly meeting to be held on 7/28.” Chunghwa Picture Tubes, LTD, 23 July 1999, Visitation Report, Topic: CDT Market Information Exchange and Price/Production Volume Review, CHU00030809 - CHU00030814, at 0810.01E - 0810.02E.

The cartel monitored its agreements to fix price and restrict quantity.

Cartel members also received feedback from customers about the prices being offered by other cartel members. When information received from these two sources was in conflict, cartel members challenged each other in cartel meetings.¹⁸⁹ The cartel threatened cheaters with

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- “C) 17" CDT stoppage days of various makers’ production lines in August: Various makers reported the number of stoppage days as shown in the attachment. They needed to verify Audit plans and send them to PH for compilation before Friday. Also, makers need to notify visiting/hosting staff and specify time of plant visit two days before Audit.” Chunghwa Picture Tubes, LTD, 28 July 1999, Visitation Report, CHU00030807 - CHU00030815, at 0808.01E.
 - “Meeting attendees agreed that, in order to effectively ensure price level, 17" tube production shutdown period needs to be at least 5 days in September. Each maker will provide a production stoppage plan before 8/24, and complete Audit plans for related factory zone before 8/28.” Chunghwa Picture Tubes, LTD, 20 August 1999, Visitation Report, CHU00030835 - CHU00030843, at 0837E.
 - Meeting notes have attached line-stoppage and audit plans: “Each make’s reported line-stoppage and Audit plan is attached. It was agreed that two days prior to the Audit date, the makers should notify one another of the visitors/hosts. The actual time to factory, then, does not need to be verified. Mr. Ha indicated that the makers needed to implement an actual Audit. He also made a simple record to facilitate reports from Management meeting.” Chunghwa Picture Tubes, LTD, 27 September 2000, Visitation Report (Submit), CHU00031067 - CHU00031073, at 1067.02E-1069E.

¹⁸⁹ See, e.g.,

- “President Lin [from Chunghwa] indicated that after the *Top Level* reached a conclusion regarding the price issue, the *Working Level* personnel should actually *Review* the market price situation at each meeting, and if abnormality appears, then they should find out the real price. The saboteur will be questioned thoroughly. The matter will then be reviewed at the *Top* meeting to seek a solution.” Hsieh, Chun-Mei (Christina), 13 October 1999, Contact Report, Meeting Topic: CDT Regular Exchange Meeting, CHU00030888 - CHU00030893, at 0890E.
- “As to our question that SDI [Samsung] is Offering Thomson a lower price in order to grab orders (200k for the first half of 2001), SDI responded that its price remains at \$25.5. Although those on the front line window believe that price should be lowered, upper management has yet to authorize such a move. Based on the request from Thomson, a price decision should be made within 1 week.” Chunghwa Picture Tubes, LTD, 21 December 2001, Visitation Report (Submitted), CHU00036406 - CHU00036407, at 6406.02E.
- “SDI [Samsung] flatly denied our suspicion that it has offered Sharp-Spain with prices as low as (ITC EU\$34=US\$23). We explained that considering manufacturing cost in Europe factories, such low prices should not have been offered in EU market. However, it admitted that its upper management offered Thomson \$24.2 in first quarter in order to grab orders with low price, but they later increased its 10" price to balance it out after consideration. CPT stressed that such a practice is wrong and CPT’s share at Thomson cannot be grabbed by SDI.” 22 February 2002, Visitation Report, CHU00036394 - CHU00036395, at 6395.01E.
- “First of all, LPD questioned the announced total sales volume of SDI [Samsung] and its somewhat concealment on its deliveries made to SEC and Proview, since there are significant differences from the data obtained by LPD. It tried to switch focus and complained that the agreed upon market share ratio by the three makers are unrealistic; followed by attacking SDI is secretly causing trouble with AOC. Actual delivery in June and July is far higher than the data announced.” Yun, Ling-Yuan, 21 July 2003, CDT Market Review, CHU00005963, at 5963.01E.
- “When it was mentioned that the agreed price of the three companies was violated, there was no notice to our company while starting business to Proview, and our company sought the understanding of both companies when starting with Philips, Lite-On Biz and so on, they said that they would talk again to the head office. However, when our company denies this by saying, ‘Is it not \$43.5 that is our company’s price

punishment in the form of price competition from the cartel.¹⁹⁰ The cartel's monitoring and punishment efforts induced cheaters to comply with cartel policies on at least several occasions.¹⁹¹

of Proview', they then requested confirmation once again." Samsung SDI, 15 November 2004, Report the results of the Glass working meeting on Nov. 15, SDCRT-0090350 - SDCRT-0090353, at 0351E.

- "During the meeting, we objected to LPD's lowering its prices to AOC secretly, reporting a lower-than-actual shipment volume and eroding our market shares, LPD's only response was to deny." Chunghwa Picture Tubes, LTD, 29 March 2005, CDT Market Report, CHU00014202 - CHU00014206, at 4203E.

¹⁹⁰ See, e.g.,

- "14" CDT, under the circumstances such that the market as a whole has not tended toward worsening, [Chunghwa] still maintains its original selling price foundation to all its customers. Even Mag/Delta, etc., who are eager to get into exports, also conform to original foundation quotes. Requested that TSB [Toshiba] understand, and not be misled by its customers, maintaining 14" selling price together. But if the 14" price war really begins, TSB should understand that [Chunghwa] has the best capabilities to respond accordingly. At that time, TSB 14" CDT operations will be even more difficult." CPT, Du, Ching-Yuan (Michael), 17 June 1996, Customer Contact Report, CHU00028297 - CHU00028298, at 8297E.
- "PH [Philips] commented that if SDD [Samsung] continued to disrupt the 14" market, there is no guarantee that it will follow rules with the 15"/17". If SDD's misconduct is not corrected, PH would be forced to take drastic actions under the pressure of high inventory." Chunghwa Picture Tubes, LTD, 13 January 1999, Visitation Report, CHU00030698 - CHU00030700, at 0698.03E.
- LPD proposal: "Penalty if company cheat prices (1) Person in charge & manager will be dispelled [sic] (2) Other 2 company [sic] will attack trouble maker's major customer." Samsung SDI, 2002, SDCRT-0087953, SDCRT-0087953 - SDCRT-0087962, at 7953E.
- "SDI's M/S [market share] for SEC changed from Q1/85% --> Q2/80%, September only has 70% or so. If [Chunghwa] does not cooperate, then SDI has to lower the price for SEC, or to fight for share in AOC or L-On." CPT, 24 August 2005, Letter head: Hongxi Creek Resort Ta Shee Resort, CHU00017115, at 2.

¹⁹¹ See, e.g.,

- "Director Liu said that SDD's use of bottom price had caused harm to [Chunghwa]. He asked SDD to find a way to remedy. For example, at present, regarding Acer, the greatest harm, Director Liu asked him to raise the price to USD64.00/pc or restrict its supply volume on the ground that the output was not smooth. Mr. Lee claimed that it was Mr. Park at its Malaysia plant who had quoted to Acer USD 60.00/pc for 14". Although it does not violate its policy, he would try to find out whether there would be remedial measures, and would discuss this matter again at the formal meeting at 5:00 PM on 2/25/97." Chunghwa Picture Tubes, LTD, 24 February 1997, Customer Contact Report, Contents Exchange of Opinions Regarding 14" CDT Price, CHU00028763 - CHU00028767, at 8764E.
- "Regarding LG's offer of less than \$93 for 17" screens [bullet] LG asserted that the offer below \$93 is a rumor and agreed not to offer below \$93 in the future." Samsung SDI, 31 July 1998, 8th CDT Industry Meeting (July 31) Results, SDCRT-0086419 - SDCRT-0086420, at 6420E.
- "Director Liu explained that although LG still has some under the table conduct, but being under the supervision by everyone, they are being pushed towards making most offer at the agreed bottom price." CPT, Liu, et al., 25 August 1998, Sales Department Customer Contact Report, CHU00028463 - CHU00028464, at 8464E.
- "[Chunghwa] complained of efforts by SDI to grab orders for Thomson 14" by lowering prices, growing from 3-5K/M to 30K/M. In defense, SDI said its quoted price is \$25.5 sold jointly with 10" and that although the customer had requested a price reduction, that has not been approved. [Chunghwa] questioned that SDI's increase in orders was already a fact and had a clear impact on [Chunghwa] deliveries. Finally, SDI indicated that it plans to reconfirm the sales prices and make a report at the next meeting. If low

f) The cartel allocated customers to suppliers

The cartel divided the market using two schemes. Major customers were allocated to cartel members, a primary supplier and one or more secondary suppliers.¹⁹² Primary suppliers' prices were fixed by the cartel at levels slightly below the prices set by the cartel for secondary suppliers.¹⁹³ The differential between the primary and secondary suppliers' prices induced customers to make a larger share of their purchases from primary suppliers than from secondary suppliers. For many major customers, such as AOC, Lite-on, LGE, Philips, Proview, and SEC,

pricing can be proven, it will then readjust the price back to the agreed prices between various parties." Chunghwa Picture Tubes, LTD, 18 January 2002, Visitation Report, CHU00036392 - CHU00036393, at 6392.01E.

¹⁹² See, e.g.,

- "Still strong feeling about: [para.] Vestel is oriented to have TH [Thomson] as 1st supplier and SDI [Samsung] as 2nd source while...Beko oriented to LPD as preferred supplier and SDI and [sic] 2nd source." Samsung SDI, 04 December 2003, Paris Meeting, SDCRT-0088661 - SDCRT-0088674, at 8672.
- "JVC [:] SDI/T-CRT will be the two suppliers. (The LPD model has been eliminated.) Based on S Company's intention, the G/L [guideline] setting was lowered." MT Picture Display, 18 June 2004, ASEAN MTG (Small and Mid-Sized Units), MTPD-0493552 - MTPD-0493554, at 3553.
- "SDI [Samsung] suggests each customer should have a major vendor to control price/QEY [sic] [quantity] to gradually to [sic] reach that goal that each customer only have two CDT makers for supply." CPT, 24 August 2005, Letter head: Hongxi Creek Resort Ta Shee Resort, CHU00017115, at 1.
- "Agreed on the introduction of the 2 Vendor System by each customer for co-survival of 3 companies from '06...M/S details (agenda) from each customer will be discussed in the Working-Level meeting." Samsung SDI, 30 September 2005, G/S MTG Result Report, SDCRT-0091687 - SDCRT-0091691, at 1689E.

¹⁹³ See, e.g.,

- "PH/OEC asked [Chunghwa] to contact IRICO, and explain to IRICO the group's unanimous acknowledgement of its primary position to VESTEL. The three parties will not contact VESTEL for promotions this year and hope that next year, IRICO can increase price to \$30 (without tax). PH guarantees that its price can be higher than IRICO's by \$1, and the largest supply amount will not be more than 20-25 k/m, and if possible, he will visit IRICO (Date: October 11, awaiting for confirmation from PH [Underlined by hand])." Chunghwa Picture Tubes, LTD, 02 October 1999, Business Report Summary, Topic: European 14" CTV Tube Market, CHU00029048 - CHU00029049, at 9048.01E.
- "[bullet] In order to have stable price it is necessary to have big difference of share and reasonable price gape [sic] between major & minor supplier. [bullet] At least US\$0.5 price gap between Major & minor supplier." Chunghwa Picture Tubes, LTD, 17 June 2003, TOP Meeting Arrangement, CHU00660561 - CHU00660574, at 0573.
- "The top six major customers are AOC, Philips, EMC, L-On, SEC and LGE. The rest are in the 'other customers' category. To top six customers, 2nd tier suppliers must quote a price \$0.5 higher. This is to take this opportunity to reinforce price differentials between big and small customers for the purpose of stabilizing market shares." Chunghwa Picture Tubes, LTD, 25 March 2004, Return-from-Aboard Trip Report, CHU00031240 - CHU00031247, at 1242E.
- "The above is the 17" F baseline prices of TOP 6 Customers. LPD suggested that each major supplier of major customers could suggest adjustment to the baseline price of that customer, and the other two CDT makers can then adjust their prices according to the new baseline price and maintain the price differential. [Chunghwa] and SDI agreed in principle but this arrangement must be carried out under the premise of actual true baseline prices." Chunghwa Picture Tubes, LTD, 29 December 2004, CDT Market Report, CHU00071480 - CHU00071482, at 1480E.

the cartel also established targets for the shares of the customer's purchases to be supplied by each of the cartel members to which the customer was allocated.¹⁹⁴

The cartel also divided the market as a whole by establishing target shares of all CDT sales for each cartel member.¹⁹⁵

g) The cartel used most-favored customer clauses

Cartel members employed most-favored customer clauses in purchase agreements.¹⁹⁶ These terms promised customers they would receive prices no worse than prices charged other

¹⁹⁴ Most instances of this conduct of which I am aware were allocations of shares of CDT customers to cartel members; I am aware of one instance in which a CPT customer was allocated to cartel members. See, e.g.,

- “Mr. Na hoped that they could cooperate closely with [Chunghwa] on delivery quantity/price [to ADI] for mutual benefit. He hoped that delivery amount could be maintained at the original 80K/m Base. SDD would take 50K/m (60%) and [Chunghwa] 30K/m (40%) of M/S.” Chunghwa Picture Tubes, LTD, 09 April 1998, Visitation Report, CHU00028642 - CHU00028644, at 8642.03E.
- Regarding division of a CPT customer: “With Thai-CRT/TEDI’s promise that they would not grab Chunghwa Picture Tube’s M/S [market share] orders (maintained at the original 50%) and that they will follow the prices, the Korean makers requested Chunghwa Picture Tube to take the lead in the price up to USD 32.00/pcs for Shipment to Orion (Thai) in January (Mr. Moon said he could arrange a meeting for the three top decision makers to confirm actual implementation method).” Chunghwa Picture Tubes, LTD, 27 November 1998, Visitation Report (Submit), CHU00029259 - CHU00029261, at 9261.01E.
- “In addition, with regard to each maker’s share with A.O.C., it was reviewed and set as follows: [Chunghwa]: 50% PH: 20% SDD/ORION: 30% (SDD and Orion will review as to how to share that 30%)” Chunghwa Picture Tubes, LTD, 18 May 1999, CPT Sales Department Customer Contact Report, Topic: China/AOC 14" CDT Price, CHU00030763 - CHU00030765, at 0764E-0765E.
- Chunghwa, LPD, and SDI review their market share allocations for twelve major CDT customers as decided in a CEO meeting. CDT, 29 April 2003, Agenda, CHU00660539 - CHU00660548, at 0545-0546.
- Agreement between Chunghwa, LPD, and SDI on market share allocation for six (reduced from twelve) major CDT customers. Allocations for LGE, Philips, and Lite-On have already been decided; they are working on a consensus for SEC, AOC, and Proview. Chunghwa Picture Tubes, LTD, 24 February 2005, Itinerary, CHU00647932 - CHU00647943, at 7941-7942.
- Proposal by Chunghwa, LPD, and SDI [Samsung] for market share allocations in 2006 for six major CDT customers. CDT, 13 March 2006, Main Discussion Agenda, SDCRT-0091715 - SDCRT-0091718, at 1718E.

¹⁹⁵ See, e.g.,

- Agreed CDT market shares of Chunghwa, LPD, and SDI for 2002 and 2003, with a comparison to actual results. Samsung SDI, February 2003, Agenda, SDCRT-0088763 - SDCRT-0088772, at 8767.
- Agreed CDT market shares of Chunghwa, LPD, and SDI for 2003 and 2004, with a review of actual market shares for January 2004. Samsung SDI, January 2004, Agenda, SDCRT-0088846 - SDCRT-0088851, at 8848.
- Agreed CDT market shares of Chunghwa, LPD, and SDI for 2005, with a review of actual January and February 2005 market shares. Chunghwa Picture Tubes, LTD, 24 February 2005, Itinerary, CHU00647932 - CHU00647943, at 7935.

¹⁹⁶ See, e.g.,

- From a JVC purchase order with Hitachi America (the ordered product is a CPT): “Seller represents and warrants that the prices are no higher than are currently available from Seller to any other purchaser of similar quantities of substantially identical goods. Any taxes with respect to or on account of the goods

customers, and helped to maintain cartel discipline by raising the cost of cheating: if a cartel member cheated by offering low prices to one customer, it had to offer the same low prices to all customers that had been granted most-favored customer status. This reduced the incentive for a cartel member to cheat on the cartel agreement by lowering prices.¹⁹⁷

h) Several Defendants participated in the LCD cartel

Several cartel members or their corporate relatives also participated in the LCD cartel, which lasted from approximately 1999 to 2006,¹⁹⁸ including: Chunghwa, Hitachi, LGE, Philips, LPD

ordered hereunder shall be paid by Seller unless expressly otherwise prescribed by law.” JVC, 30 July 1998, JVC Purchase Order, HEDUS-CRT00062277 - HEDUS-CRT00062278, at 2277.

- From an e-mail from Chunghwa to Dell: “We’ve understood that there’s some rumor about [Chunghwa’s] Jan [January] pricing, yet it’s totally untrue. We haven’t [sic] quoted Jan price to any customers at this moment. [para.] You may have our words that you have the MFN among our customers.” Wang, Cherry H.C., 08 December 2004, MFN, CHU00635116, at 5116.
- From a general purchasing agreement between Matsushita Electric Industrial and Philips Consumer Electronics: “Supplier shall at all times offer the most favourable prices for the Standard Products only to Buyer, meaning that such prices shall be no less favourable than those currently extended to other customers of Supplier at substantially the same timing, under substantially the same purchase volumes and other conditions.” Matsushita Electric Industrial, Philips Consumer Electronics, 20 January 2006, General Purchasing Agreement, MTPD-0436378 - MTPD-0436396, at 6384.
- From a meeting presentation between Chunghwa and Samsung: “[Chunghwa] will provide MFP (Most Favorable Price) to SEC to secure 410K q’ty. If 37” q’ty exceed 260K, 1% incentive will be granted. Review shipment record by quarter, as well as incentive.” Chunghwa Picture Tubes, LTD, 21 April 2006, Samsung & CPT Top management meeting, CHU00011820 - CHU00011839, at 1827.
- From a purchasing agreement between MTPD Indonesia and Sanyo Electronics Indonesia: “The price of the Products shall be decided by the parties hereto upon mutual consultation from time to time; provided, however, prices for the Products shall at no time be greater than the most favorable prices extended at that time to the Seller’s most favored customers, taking into account the deference of specifications and delivery terms.” PT Sanyo Electronics, PT MT Picture Display, 09 October 2006, Basic Agreement between PT Sanyo Electronics and PT MT Picture Display, MTPD-0336313 - MTPD-0336331, at 6316.
- From an e-mail from Chunghwa to Philips: “We provide favored-nation price to Philips and need Philips to mask the price. Please help to confirm the acceptance of 17” final pricing (\$127.5) and the mask pricing (\$128.0).” Wang, Cherry H.C., 26 October 2006, RE: OCT pricing, CHU00633824 - CHU00633826, at 3825.

¹⁹⁷ See, e.g.,

- Cooper, T.E., 1986, Most Favored Customer Pricing and Tacit Collusion, *Rand Journal of Economics*, Vol. 17, 377-388.
- Jacquemin, Alexis and Margaret E. Slade, 1989, Cartels, Collusion, and Horizontal Merger, *Handbook of Industrial Organization*, Vol. 1, at 422.
- Salop, Steven C., 1986, Practices That (Credibly) Facilitate Oligopoly Coordination, *New Developments in the Analysis of Market Structure*, MIT Press: Cambridge: Massachusetts, (Joseph Stiglitz and Frank Mathewson, eds.).
- Tirole, Jean, 1988, *The Theory of Industrial Organization*, The MIT Press: Cambridge, Massachusetts, at 330-332.

¹⁹⁸ See, e.g.,

(the joint venture between LGE and Philips), Mitsubishi, MTPD, Toshiba, and Samsung. The DOJ prosecuted members of the LCD cartel for violating Section 1 of the Sherman Act, resulting in numerous guilty pleas and fines totaling hundreds of millions of dollars. Chunghwa, Hitachi, and LG Display Co. (a LCD joint venture between LGE and Philips) pleaded guilty and paid criminal fines.¹⁹⁹ Toshiba was found guilty by the jury in the direct purchaser case and was ordered to pay \$87 million to class members.²⁰⁰ In addition, competition agencies in China, the European Union, and South Korea fined Chunghwa, LG Display, and Samsung a total of nearly \$476 million for their participation in the LCD cartel.²⁰¹

It is well established in the economics literature that such “multi-market contact” can be conducive to cartel success.²⁰²

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- 28 March 2010, Order Granting Indirect Purchaser Plaintiffs’ Motion For Class Certification; Denying Defendants’ Motion to Strike Modified Class Definitions; Granting Motions to Strike Untimely Declarations, In re: TFT-LCD (Flat Panel) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).
 - 28 March 2010, Order Granting In Part and Denying In Part Direct Purchaser Plaintiffs’ Motion For Class Certification; Granting Defendants’ Motion to Strike Untimely Declarations, In re: TFT-LCD (Flat Panel) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).

¹⁹⁹ See, e.g.,

- U.S. Department of Justice, 12 November 2008, LG, Sharp, Chunghwa Agree to Plead Guilty, Pay Total of \$585 Million in Fines for Participating in LCD Price-fixing Conspiracies, <http://www.justice.gov/opa/pr/2008/November/08-at-1002.html>, accessed 31 March 2014.
- U.S. Department of Justice, 10 March 2009, Hitachi Displays Agrees to Plead Guilty and Pay \$31 Million Fine for Participating in LCD Price-Fixing Conspiracy, <http://www.justice.gov/opa/pr/2009/March/09-at-210.html>, accessed 31 March 2014.

²⁰⁰ James, Ben, 11 September 2012, Toshiba To Pay Direct LCD Buyers \$30M In Price-Fixing MDL, Law360, <http://www.law360.com/articles/377122/toshiba-to-pay-direct-lcd-buyers-30m-in-price-fixing-mdl>, accessed 08 April 2014.

²⁰¹ See, e.g.,

- Qi, Liyan, Min-Jeong Lee and Lorraine Luk, 04 January 2013, China Fines Makers of LCD Screens, The Wall Street Journal, <http://online.wsj.com/news/articles/SB10001424127887323374504578220862089391652>, accessed 08 April 2014.
- Lee, Jung-Ah, 31 October 2011, Seoul Fines Six LCD Manufacturers in Price-Fixing Case, The Wall Street Journal, <http://online.wsj.com/news/articles/SB10001424052970204528204577007682854719686>, accessed 08 April 2014.
- White, Aoife, 08 December 2010, LCD-Panel Makers Fined \$649 Million by European Union for Price Fixing, Bloomberg, <http://www.bloomberg.com/news/2010-12-08/six-lcd-panel-makers-fined-649-million-by-european-union-for-price-fixing.html>, accessed 08 April 2014.
- Lipman, Melissa, 27 February 2014, LG, InnoLux LCD Cartel Fines Trimmed By \$23M In EU Court, Law360, <http://www.law360.com/articles/513907/lg-innolux-lcd-cartel-fines-trimmed-by-23m-in-eu-court>, accessed 08 April 2014.
- Kanter, James, 08 December 2010, Europe Fines Five Flat-Panel Screen Makers for Price Fixing, The New York Times, http://www.nytimes.com/2010/12/09/business/global/09fine.html?_r=0, accessed 08 April 2014.

²⁰² See, e.g.,

4. The evidence confirms the cartel successfully raised prices

a) The cartel raised the price of the CRTs for which we observe target prices

As a direct test of whether the cartel affected the prices of CRTs, I implemented a regression analysis of whether target prices “Granger cause” actual prices. As described in Section VIII.A.3.b), the CRT cartel members set target prices to which they were to adhere when selling CRTs. By setting these prices, cartel members sought to cause the prices of CRTs to increase above their competitive levels. The regression analysis I undertook examined whether the cartel was successful in its efforts.

I have found documentation of over 130 meetings between cartel members at which target prices were set. See Exhibit 1. I matched the target prices with the prices direct purchasers paid for the corresponding tubes.²⁰³ I have been able to match target prices to approximately 29.7% of CPT sales and 39.0% of CDT sales in the data produced by Defendants.²⁰⁴

There are several possible reasons I did not observe more target prices. Cartel members understood that setting target prices was illegal and indicated attempts to conceal such activity.²⁰⁵

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- Bernheim, B. Douglas and Michael D. Whinston, 1990, Multimarket Contact and Collusive Behavior, RAND Journal of Economics, Vol. 21(1), 1-26.
 - Bond, Eric, 2004, Antitrust Policy in Open Economies: Price Fixing and International Cartels in Handbook of International Trade, Volume II: Economic and Legal Analyses of Trade Policy and Institutions, Choi and Hartigan (eds), Blackwell Publishing.
 - Deltas, George, Serfes, Konstantinos, and Richard Sicotte, 1999, American Shipping Cartels In The Pre-World War I Era, Research in Economic History, Vol. 19, 1-38.

²⁰³ I matched target prices to actual observed cartel prices using the following procedure. I defined a product group to be all CRT models with the same application, size, and finish (bare or ITC). Most of the Defendant sales data are not sufficiently detailed to match on tube shape (round or flat). For the analysis described in this sub-section, I ignore shape data when available and treat flat and round tubes the same. For each manufacturer and customer pair, I calculated the average price of all products within a group sold during each calendar quarter. These are the actual prices. I then matched these actual prices to target prices that were applicable to each manufacturer, group, and time period. If the meeting notes did not specify the manufacturers to which a target price applied, or if the same target price applied to all manufacturers at the meeting, I assumed that it applied to all manufacturers in the cartel. Meeting notes typically included the month or quarter when a target price was to be effective. If different meetings produced multiple target prices for the same quarter, I used an average of the available target prices, weighting each target price according to the length of time it would have been in effect.

²⁰⁴ See combine_target_defendant.smcl in my backup for calculations.

²⁰⁵ See, e.g.,

- “Large size price trend: 25V \$102-103 (major customer, bottom price standard) Based on North America antitrust law, CRT companies are not to discuss prices with each other, but in my opinion it appears to be a price we heard from Philips [return] Price gap between 25v and 27V: Tube (ITC standard) around \$35, set retail standard \$40-50.” Im, Chul Hong, 12 January 1999, North America CPT companies meeting summary, SDCRT-0002526 - SDCRT-0002528, at 2528E.
- From meeting notes: “The industry meetings should remain confidential in consideration of international antitrust laws”. Shenzhen Samsung Display Device, 05 August 1999, The Chinese Industry Meeting (August), SDCRT-0086672 - SDCRT-0086674, at 6672E.
- From an internal Toshiba e-mail: “* Below, I ask you to destroy after reading * [paragraph] I am sure you are aware, but it is a fact that information exchange is being conducted occasionally among the three

Target prices may have been set over the phone or not written down. For this reason alone, it is almost certain that the cartel set target prices that we do not observe.

In addition, the cartel did not need to explicitly set target prices for all products to increase prices for all products because the prices of various CRT models are closely and predictably related; a few key tube characteristics such as size and application account for most of the variation in CRT prices. See Section VIII.A.4.b)(2). By explicitly setting a target price for certain tubes, the price of other tubes would rise as well.

Also, setting target prices was not the only way to collusively raise prices. For example, the cartel restricted output (see Section VIII.A.3.c)), which also raised prices above the competitive level. The cartel shared sensitive pricing information and allocated customers (see Sections VIII.A.3.b) and VIII.A.3.f)), which also results in higher prices. It is possible that the cartel would set target prices for some CRTs while using one or more alternative methods to raise the price of other CRTs.

Regardless of the reason, I observed target prices that apply to some, but not all, of Defendants' tube sales. The prices charged by Defendants closely tracked the collusive target prices; see

companies, Samsung, Orion and TAEC (TDD), regarding NAFTA's mid-size tubes. It is mainly general information, but since there are times that specific matters are discussed such as each's CPT supply proposals for each customer's (TV) planned production volume, as a result, the actual situation is that each Bulb store has considerably accurate understanding of information such as which customer is securing how much CPT for the set production volume." Yoshino, Michihiro, 24 January 2000, E-mail, Subject: Re: Destroy After Reading: GM Mizushima's complaint regarding Funai Electric's TDD 19v CPT Inquiry, TSB-CRT-00042440 - TSB-CRT-00042443, at 2440.

- An internal Toshiba e-mail with a subject line "SDI information - Confidential- please destroy after reading" summarized information obtained from Samsung Japan. The e-mail covered SDI organization, CDT factory utilization rate, planned monthly production figures, and average prices for various CDTs during January - March of 2001. Yamamoto, Yasuki, 15 January 2001, E-mail, Subject: SOI information - Confidential- please destroy after reading, TSB-CRT-00041746 - TSB-CRT-00041749, at 1746 - 1747.
- An internal MTPD e-mail has the subject, "(Confidential) Thomson Mexicali Factory Information". The body text says, "Since this is in violation of antitrust, please do not leak it to others. Thomson production information. Sales figures obtained from the marketing unit at the Paris headquarters. It's the Marion A59 25V." The e-mail was forwarded to other MTPD employees in the U.S. with the warning "Please treat this as strictly confidential. It is information about the advancement of business." Kinoshita, Ayumu, 02 July 2003, E-mail, Subject: FW: (Confidential) Thomson Mexicali Factory Information, MTPD-0035375 - MTPD-0035376, at 5375E.
- An internal MTPD e-mail discussed a meeting held with Samsung and LPD on November 28, 2003. The subject line says, "*Highly Confidential/Destroy after Reading* South Korean CRT information (quantities and lines)". The e-mail begins with, "I am reporting on the substance of information about SDI and LPD I obtained on November 28, 2003, as follows. Please treat this matter as *highly confidential*, and please keep the fact that this meeting, meeting minutes, and so on exists as *highly confidential*." Kinoshita, Ayumu, 11 December 2003, E-mail, Subject: FW Highly Confidential/Destroy after Reading South Korea CRT information (quantities and lines), MTPD-0038856 - MTPD-0038859, at 8857E.
- A Glass Meeting agenda has "The Method to avoid anti trust law" on the Any Other Business (A.O.B.) page. Chunghwa Picture Tubes, LTD, 17 August 2004, Itinerary, CHU00660717 - CHU00660727, at 0727.
- From an internal MTPD e-mail: "This is the industry meeting memo. Destroy after reading." Attachment is a meeting memo from February 2007. Sanogawaya, Masaki, 09 November 2007, E-mail, Subject: Meeting memo, MTPD-0543148 - MTPD-0543150, at 3148E.

Exhibits 30-36.²⁰⁶ The fact that actual prices closely track target prices indicates that the cartel succeeded in charging the agreed-upon prices. To confirm the causal relationship between target and actual prices, I performed a widely-accepted economic test of causation: the Granger causation test.²⁰⁷ This analysis determines whether one kind of information (here, target price) can reliably predict a future outcome (here, actual price). If it does, then that source of information is said to “Granger cause” the outcome.

I used this analysis to determine whether the cartel’s target prices predict the actual prices Defendants charged direct purchasers. I estimated separate equations for CDTs and CPTs, which allows the target price to influence the actual price differently for each type of tube. I calculated the actual weighted-average quarterly selling price for each application, size, finish, manufacturer, and customer combination. For example, I calculated the average selling price for all 17" ITC CDTs sold by Samsung to Compal in 1999 Q3.

I estimated a regression in which the logarithm of actual price was a function of the logarithm of the previous quarter’s actual price, the logarithm of the matched target price, the size of the CRT multiplied by the logarithm of the cost of glass (an input needed to produce CRTs), and measures of global economic growth and unemployment (variables to indicate the strength of demand).²⁰⁸ Including the lagged actual price, glass costs, and macroeconomic variables ensures that the estimated relationship between target and actual prices was not simply the result of general factors affecting supply and demand for CRTs. I also included application, size, finish, manufacturer, and customer fixed effects.

The results of the regressions are presented in Exhibits 37 and 38. For both CDT and CPT, the collusive target prices exhibit a strong, positive, and economically meaningful predictive effect on the actual prices charged by Defendants; that is, when the target price increased, so did the actual price. These effects are statistically significant at the 1% level.

For the products included in this analysis, I found that target prices strongly predict the price Defendants charged direct purchasers. This is clear evidence that the cartel’s activities increased the price for CRTs for which the cartel set targets.

²⁰⁶ Exhibits 30-36 include actual and target prices for 15, 17, and 19-inch CDTs, and 14, 20, 21, and 29-inch CPTs. These sizes account for 84% of tubes represented in the Defendant sales data.

²⁰⁷ See, e.g.,

- Granger, C. W. J., 1969, Investigating Causal Relations by Econometric Models and Cross-spectral Methods, *Econometrica*, Vol. 37, No. 3, 424–438.
- Kaufmann, Robert K., Dees, Stephane Dees, Karadeloglou, Pavlos, and Marcelo Sanchez, 2004, Does OPEC Matter? An Econometric Analysis of Oil Prices, *Energy Journal*, Vol. 25, Issue 4, 67-90.
- Soytaş, Ugur and Ramazan Sarib, 2003, Energy consumption and GDP: causality relationship in G-7 countries and emerging markets, *Energy Economics*, Vol. 25, 33-37.

²⁰⁸ The (natural) logarithm of a number is the exponent (or power) to which the number $e \approx 2.72$ must be raised to equal that number. For example, the natural logarithm of 5 is approximately 1.609 because e raised to the power of 1.609 is equal to 5. Logarithmic transformations of the sort employed here are commonly used to reduce the variance of the data used in the model, which can be desirable when working with data that cover a wide range of values. Another feature of using the logarithmic transformation in multiple regression is that the estimated coefficients are interpreted as elasticities. For example, a coefficient estimate of 2 for the variable $\ln(X)$ would imply that a 1% change in the value of X is associated with a 2% change in the value of Y .

b) The cartel succeeded in raising the prices of all CRTs

Although we do not observe target prices for all CRTs that were sold, there is strong evidence the cartel raised the prices of all CRTs.

(1) A profit-maximizing cartel seeks to raise the prices of all products

It is uncontroversial that cartels have the incentive to set prices above the competitive price.²⁰⁹ I have seen no evidence to suggest that any model of CRT was exempt from this general rule. The reason cartels have this incentive is straightforward: when a cartel controls all or most of the supply in a market, consumers' only alternative to buying at the cartel's price is to substitute to goods outside the market.

Cartels' incentive to raise the prices of all of its cartelized products is reinforced when a cartel sells multiple products that substitute for each other: effectively raising the price of each CRT requires that the prices of its potential substitute CRTs also be raised, as the following example illustrates. Suppose the CRT cartel raised the price of 15" CDTs above the competitive level, but left the price of 17" CDTs at the competitive level. Given the relative price increase of 15" CRTs, some consumers would substitute away from 15" monitors towards 17" models, thereby escaping the price increase. Rational cartelization (that is, operating the cartel to maximize the joint profit of cartel members) requires that the cartel set prices that eliminate opportunities for buyers to escape overcharges. Thus, in this hypothetical example, rather than raise the price of the 15" CDT alone, the cartel would earn higher profits by raising the prices of both the 15" and 17" CDTs. In that way, consumers cannot avoid the overcharge on the 15" CDT by substituting to 17" CDTs. Similarly, a profit-maximizing cartel seeks to raise the prices in all transactions, regardless of the identity of the purchaser or the location of the end-user.

When Chunghwa's Vice President of Sales was asked at his deposition what would happen if the price of 17" tubes were raised without raising the price of 15" tubes, he did not even accept the premise that such a thing would have happened, saying that the cartel did not even discuss such a possibility and, citing the professionalism of those setting prices, said that they "would certainly raise the prices at the same time", absent any pre-existing imbalance in the relative price that needed correction.²¹⁰

Q. Let's assume for a moment that you were to raise the price of 15-inch color picture tubes, without changing the price of the 17-inch color picture tubes. Do you have an understanding, based upon your years of experience in the CRT business, what effect, if any, that would have on the relative mix of sales of 15-inch and 17-inch CPT tubes?

THE WITNESS: This question is not difficult. We are professionals in this industry. We are selling tubes like professionals if not experts. How could we only change the price of a 15 inches tubes without changing the prices for 17 inches of tubes? Of course, we would consider the overall market structure and the market acceptance and the reasonable cost gaps. We would certainly raise the prices at the same time.

²⁰⁹ "In any market, firms have an incentive to coordinate their production and pricing activities to increase their collective and individual profits by restricting market output and raising the market price. An association of firms that explicitly coordinates its pricing or output activities is called a cartel." Carlton, Dennis and Jeffery M. Perloff, 2005, *Modern Industrial Organization*, Fourth Edition, Addison-Wesley Longman, Inc., at 122.

²¹⁰ Deposition of Chih Chun-Liu, Vol. II, 20 February 2013, at 296:3 - 298:1.

Q. [...] Do you recall whether the participants in the group and one-on-one meetings would have discussions about the effect – possible effects of changing one – the price of, say, 15-inch tubes on the sales on 17-inch tubes?

THE WITNESS: Not really considering the price will be an overall comprehensive consideration of all products, we would not focus only on one type of products unless the cost gaps were unreasonably different. We would not only raise the price for 15 inches without changing prices of all other items unless there is a particular situation that the purchase of 17 inches was not that strong and the purchase for 15 inches was particularly strong. Otherwise we would have an overall comprehensive consideration of the products categorically.

Of course, the pricing principle discussed by Mr. Liu applies more generally than to just the two tubes he was asked about. This same logic applies to flat versus round CDTs, bare versus ITC CPTs, and other CRT models that substitute for each other. More generally, a cartel's choice of prices seeks to maximize profit; doing so requires applying the cartel overcharge over products in such a way that substitution by consumers has the least impact on profits. Economists have long recognized the importance of a cartel establishing a price structure that accounts for such differences in products and customers.²¹¹

(2) The cartel did not need to set target prices for every CRT in order to raise all CRT prices

It was not necessary for the cartel members to set target prices for every type of CRT in order to raise the prices for all CRTs. As discussed in my class certification report and rebuttal,²¹² the prices of different types of CRTs are related to each other through a price structure. That is, standard market forces impose a relationship between CRTs of different types, say between a 15" flat CDT and a 15" round CDT or between a 21" widescreen CPT and a 25" widescreen CPT.

The cartel took advantage of the relationship between different types of CRTs by setting price differentials corresponding to common product differentiators. Exhibit 39 catalogs price differentials set by the cartel including differentials related to specific cartel members, finish (ITC or bare), customer identity or location, neck type (normal or mini-neck), and mask type. Chunghwa's VP of sales Mr. Liu's testimony indicates that, even if in some cases the cartel did not explicitly set a price differential corresponding to some product differentiator, pricing professionals would know that in the absence of such a target price differential, their pricing decisions should "consider the overall market structure and the market acceptance and the reasonable cost gaps".²¹³ These considerations would lead cartel members to recognize that if the price of a model without the differentiator were raised, rational pricing requires that the price of the differentiated product should also be raised, and they "would certainly raise the prices at the

²¹¹ "It is part of the task of maximizing industry profits to employ a price structure that takes account of the larger differences in the costs of various classes of transactions ... A price structure of some complexity will usually be the goal of collusive oligopolists." Stigler, George J., February 1964, A Theory of Oligopoly, The Journal of Political Economy, Vol. 72, No. 1, 44 - 61, at 45.

²¹² See,

- Netz Class Cert Report, at 68 - 71.
- Netz Rebuttal, at 42 - 43.

²¹³ Deposition of Chih Chun-Liu, Vol. II, 20 February 2013, at 296:3 - 298:1.

same time". Other cartel participants also recognized the relationship between prices of different CRTs.²¹⁴

The hedonic regression analyses that I implemented for class certification proceedings likewise show that CRT prices are determined primarily by product attributes. This analysis showed that

²¹⁴ See, e.g.,

- "The 14" CDT price especially directly affects the 15" CDTs market fluctuation." Chunghwa Picture Tubes, LTD, 09 February 1996, Visiting Report, CHU00028302 - CHU00028304, at 8303.01E.
- "14"/15"'s current pricing continue to slide, although 15" is a bit more stable, but it will still be squeezing 17"'s pricing. By 94/E [end of 1994], the price differentials between tube sizes would be: 15"/14": USD 40.00/pc- 17"/15": USD/10/pc. Based on market condition, current selling price of 14" has reached the price of 94/E, price differentials between sizes are being maintained in general, but if the price of 14" does not stabilize, then the prices of 15"/17" would again be squeezed to drop; if CDT price does not stabilize, it would be not be beneficial to Monitor or picture tube industry. CDT industry should strengthen contacts and mutually agree to reduce production in order to stabilize pricing." CPT, Du, Ching-Yuan (Michael), 23 September 1996, Customer Contact Report, CHU00028400 - CHU00028401, at 8400.02E - 8401E.
- "Mr. Moon emphasized that if we were looking forward to another round of price rise for 17", then the market price of 19" absolutely needed to be raised." Hsieh, Chun-Mei (Christina), 10 February 1999, Visitation Report, CHU00030713 - CHU00030716, at 0714.02E.
- "Also believes that the current price differential of 15"/17" tube has been narrowed down to around \$20. 17" tube should not drop price further so as to avoid impact on the demand for 15" tube." Chunghwa Picture Tubes, LTD, 09 November 1999, Visitation Report, CHU00030916, at 0916.01E.
- "SDI: 14" US market was impacted by the shortened price gap to 20", sales volume dropped 15%, but overall sales total for 2Q is similar to that of 1Q." Chunghwa Picture Tubes, LTD, 18 April 2001, Overseas Visitation Report, CHU00024560 - CHU00024562, at 4562.01.
- "How to determine price for the 29"? We should stabilize the price even if we have to stop production. If that works, the price could recover up to 1,050 from 1,000 [RMB], which will also help 21" & 25" sales. Should consider investment and imported tube price before price setting and avoid sales at unreasonable prices that may cause a deficit." May 2001, Report of Color CRT Industry Meeting, SDCRT-0087694 - SDCRT-0087698 at 2.
- Notes from a November 2003 Glass Meeting indicate widespread agreement that the price of a 21" RF [real flat] tube is closely related to the price of other small and medium-sized tubes. "21" RF [real flat] price plays a significant role for the medium & small sizes. In an effort to alleviate the pressure on 21"FS [flat square – a type of round tube]/20"/14", all attendees feel that the 21"RF price must be maintained." CPT, 07 November 2003, Market Visitation Report (Glass Meeting), CHU00030071 - CHU00030093, at 0073.01E.
- "The 21"PF [pure flat] price continues to pressure 21FS [flat square – a type of round tube], especially the A/K Type, so, should MTPD lead a 21" PF price increase in order to stretch the 21"FS and 21"PF price difference?" Chunghwa Picture Tubes, LTD, 29 April 2004, Overseas Trip Report, CHU00030005 - CHU00030007, at 0007.02E.
- "Since there is less capacity for price reductions due to the 30 VW [30 viewable inches, widescreen] investment depreciation, SDI is continuing with restructuring to prepare for the market downturn. With no excess capacity and it being unlikely that demand will increase with a reduction in price, we want to keep price cuts limited as much as possible. The concern is that the reduction in overall CRT demand will lead to falling prices, and that the collapse of 32 VP [32 viewable inches, pure flat] prices due to this collapse in demand balance will spread to 30 VW and lower. (In other words, apparently there will be no price reduction for 32V for MTPDA)." Tsuruta, Shinichiro, 24 August 2005, E-mail, Subject: Re: SDI North America Information, MTPD-0303225 - MTPD-0303228, at 3228E.

the prices Defendants charged to direct purchasers could be closely approximated by a formula common to all direct purchasers. Based on the results, I conclude that CRT prices of different types are related to each other via product characteristics, and therefore setting a target price increase for one type of CRT implies a price increase for other CRTs.

I updated the same hedonic regression of price as a function of product characteristics, a time trend, and indicator variables for buyer-seller pairs as I did previously.^{215,216} Mathematically, the regression I estimated was

$$\ln(\text{Price}_{ijt}) = \beta_0 + \beta_1 \text{Char}_i + \beta_2 \text{SB}_j + \gamma_1 \text{Time}_t + \gamma_2 \text{Time}_t^2 + \varepsilon_{ijt},$$

where Price_{ijt} is the price charged for CRT model i between seller-buyer pair j at time t ; Char_i is a vector of indicator variables for product characteristics, including aspect ratio (wide or not), size, and finish (bare or ITC) of CRT model i ; SB_j is an indicator variable for seller-buyer pair j ;²¹⁷ and the time variables allow for a trending influence on price.²¹⁸ I fitted the model separately for CDTs and CPTs. The results of the regressions are presented in Exhibits 40 and 41.

Both regressions are highly significant. The R^2 of the CDT regression is 0.91, which means that 91% of the variation in the logarithm of price for CDTs can be explained by product characteristics, buyer-seller pairs, and a time trend. The R^2 of the CPT regression is 0.97, which means that 97% of the variation in the logarithm of price for CPTs can be explained by product characteristics, buyer-seller pairs, and a time trend.²¹⁹

The results of the hedonic regressions demonstrate that the relationship between the prices of different CRT prices were predictable and determined by a handful of product characteristics. Defendants' employees, as experienced businesspeople responsible for setting CRT prices, were aware of the relationships between prices of CRTs with different characteristics.²²⁰ When the

²¹⁵ I updated the hedonics analyses to reflect (1) additional Defendant data and additional information on the interpretation of Defendant data obtained since class certification proceedings; and (2) a change from analyzing Defendant data at the monthly level to analyzing defendant data at the quarterly level. I made the latter change to better account for price adjustments occurring within a given quarter. See footnote 294 for further details.

²¹⁶ See,

- Netz Class Cert Report, at 70.
- Netz Rebuttal, at 42.

²¹⁷ Seller-buyer pairs were identified by customer names in each defendant dataset. Alternate spellings of a single customer name within a given defendant dataset resulted in separate seller-buyer pairs for each spelling variation.

²¹⁸ For notational ease, in this representation β_1 and β_2 represented sets of coefficients. The set of β_1 coefficients included coefficients for each product characteristic observed in the data. For example, there was a coefficient for each size of CRT. Similarly, the set of β_2 coefficients included a coefficient for each seller-buyer pair.

²¹⁹ I examined the variance in the logarithm of price. The variation in price and the logarithm of price are very close; see footnote 224 in Netz Class Cert Report.

²²⁰ See, e.g.,

- Size:
 - “With regard to the price differential for 14"/15", MR. MOON believes that unless it can be reduced to under USD32, it would be difficult to have any sign of improvement for 15" CDT!” Chunghwa Picture Tubes, LTD, 24 May 1996, Sales & Marketing Division Visiting Report, CHU00028968 - CHU00028969, at 8969E.

cartel agreed to change the price of certain CRTs, cartel members understood the implication such a change in price would have on the prices of other CRTs with slightly different product characteristics.²²¹ Thus, even when the cartel only explicitly set target prices for some CRTs, I

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- “21” RF [real flat] price plays a significant role for the medium & small sizes. In an effort to alleviate the pressure on 21”FS [flat square]/20”/14”, all attendees feel that the 21”RF price must be maintained.” CPT, 07 November 2003, Market Visitation Report (Glass Meeting), CHU00030071 - CHU00030093 at 0073.01E.
 - “In the event that the price range of the ultra-large set is lowered to \$220 to \$230, decrease in the price of the 27V flat is inevitable.” Samsung SDI, 10 March 2003, LPD, SDCRT-0002588 - SDCRT-0002589, at 2589E. [According to Jae In Lee, SDI defined “ultra large CPTs” as anything above 30 inches. Deposition of Chih Chun-Liu, Vol II, 20 February 2013, 310:24-311:6.]
 - Notes from Samsung’s discussion with Thomson at the 2004 CES in Las Vegas: “The burden of operating a jumbo size line is serious. They are desperately reducing prices, etc., to escape the crisis, and this is affecting the prices of even our large models.” Samsung SDI, 07 January 2004, 2004 International CES Business Trip Report (Jan. 7 - 14), SDCRT-0005180 - SDCRT-0005189, at 5183E.
 - “Promotion of 32wsf [widescreen square flat] as cannibaliser, aiming at set price difference with 29rf [real flat] < 100euro.” LG Philips Displays, 06 September 2004, Hranice, PHLP-CRT-017191.
 - “SLIM Price GAP needs to be reduced compared to NORMAL, but if the SLIM price is lowered then the 32” NORMAL price will need to go down and 29” price will need to go down, too. This is the industry’s agony.” Samsung SDI, 15 November 2005, Thomson, SDCRT-0091537 - SDCRT-0091545, at 1542E
 - “According to them they cannot get 29”SF [square flat] CTV orders from customers since 28” CTV price is approx. \$35 cheaper than 29”SF and consumers buy 28”.” MT Picture Display, 19 January 2006, MTPD-0410475, MTPD-0410475.
 - Other attributes:
 - “... the price difference between invar and AK products is known in the industry to be US\$1.5-US\$2.00.” MT Picture Display, 17 September 2004, CRT Industry Meeting, MTPD-0580795, at 0795.
 - “SLIM Price GAP needs to be reduced compared to NORMAL, but if the SLIM price is lowered then the 32” NORMAL price will need to go down and 29” price will need to go down, too. This is the industry’s agony.” Samsung SDI, 15 November 2005, Thomson, SDCRT-0091537 - SDCRT-0091545, at 1542E.
 - “Since the price differential has narrowed down, the demand for 21”FS [flat square] has clearly shifted to 21”RF [real flat].” Jimmy, Wu, Meng Ying, 07 February 2007, Market Visitation Report (Glass Meeting), CHU00030437 - CHU00030438, at 0437.02E.
 - For CDTs of the same size and specifications, Japanese manufacturers commanded a \$4 to \$5 premium compared to Samsung, which, in turn, commanded a \$2 to \$3 premium over Chunghwa. Deposition of Chih Chun-Liu, Vol. I, 19 February 2013, at 70:24 - 72:9.

²²¹ See, e.g.,

- “Q. Let’s assume for a moment that you were to raise the price of 15-inch color picture tubes, without changing the price of the 17-inch color picture tubes. Do you have an understanding, based upon your years of experience in the CRT business, what effect, if any, that would have on the relative mix of sales of 15-inch and 17-inch CPT tubes? THE WITNESS: This question is not difficult. We are professionals in this industry. We are selling tubes like professionals if not experts. How could we only change the price of a 15 inches tubes without changing the prices for 17 inches of tubes? Of course, we would consider the overall market structure and the market acceptance and the reasonable cost gaps. We would certainly raise the

expect that prices for other CRTs would be affected as well. In the next section, I test this hypothesis.

(3) Observed target prices predict actual prices of CRTs for which we do not observe target prices

As described above, I did not find documentary evidence that the cartel set target prices for all types of CRTs but the cartel had the incentive and the ability to affect CRT prices more generally. The prices of CDTs and CPTs for which I did not observe target prices closely track the target prices that I did observe. Exhibits 42 and 43 illustrate this relationship by plotting an index of target prices and an index composed of the prices of tubes for which I did not observe target prices.²²² The correlation is 0.89 for CDTs and 0.92 for CPTs, and both are statistically significant.²²³

In addition to examining the correlation between the prices of CRTs with explicit target prices and those without, I used regression analysis to confirm that the data are consistent with the cartel affecting the prices of CRTs without explicit target prices by running a similar regression analysis that I used for CRTs that had explicit target prices, as described in Section VIII.A.4.a). The analysis is slightly different because it is unclear how one would match actual CRT prices that did not have a target price to target prices. Therefore I calculated an index of CPT or CDT target prices to use in the regression analysis. If the target price index predicts the actual prices of CRTs for which I did not observe target prices, I can conclude that the cartel's target prices had the effect of raising the prices of all CRTs.

I estimated separate regressions for CPTs and CDTs in which the logarithm of the actual price is a function of the logarithm of the previous quarter's price, the logarithm of the target price index, the size of the CRT multiplied by the logarithm of the cost of glass, and measures of global

prices at the same time. Q. [...] Do you recall whether the participants in the group and one-on-one meetings would have discussions about the effect -- possible effects of changing one -- the price of, say, 15-inch tubes on the sales on 17-inch tubes? THE WITNESS: Not really considering the price will be an overall comprehensive consideration of all products, we would not focus only on one type of products unless the cost gaps were unreasonably different. We would not only raise the price for 15 inches without changing prices of all other items unless there is a particular situation that the purchase of 17 inches was not that strong and the purchase for 15 inches was particularly strong. Otherwise we would have an overall comprehensive consideration of the products categorically.... Q. I want to make sure I understood what you just said. You, as I understand it -- or to what extent did the comprehensive consideration of all the products that would be done during the meetings include agreements on prices of each of the product sizes for CRTs, for example, 15, 17, 19 and 21? [...] THE WITNESS: I believe I have said it. The consideration would cover all sizes. If we want to raise the prices that will be for all." Deposition of Chih Chun-Liu, Vol II, 20 February 2013 at 296:3 - 298:19.

²²² The Fisher price index for a given month is a weighted average of the changes in target prices from the previous period. It uses as weights both the current and previous months' sales volumes from Defendants' sales data. These monthly index values are then "chained" together to produce a measure of the change in target prices over longer periods of time. This approach allowed me to measure average changes in target prices over time despite changing composition of target prices from period to period.

Most of the Defendant sales data do not include detail on tube shape. For the purpose of calculating the price indices used in this sub-section, I assumed the tube was round if shape wasn't specified and excluded sales of tubes which were identified as flat screens.

²²³ See actual_price_index.smcl in my backup for calculations.

economic growth and unemployment. This is identical to the model used in Section VIII.A.4.a) with the matched target price replaced by the index of target prices.

The results of the regressions are presented in Exhibits 44 and 45. I found that for both CDT and CPT, the collusive target price indices exhibit a strong, positive, and economically meaningful predictive effect on the actual prices charged by Defendants. These effects are statistically significant at the 1% level.

There are at least two reasons why higher target prices strongly predict higher prices for CRTs that did not have explicit target prices. The most straightforward reason is that cartel almost certainly set some target prices that I did not observe. These unobserved target prices would be positively correlated with the observed target prices given a profit-maximizing cartel. The target price index in the regression thus acts as a proxy for the unobserved target prices.

Another explanation for the relationship between the target price indices and the prices of CRTs that did not have explicit target prices is that the cartel used methods in addition to target prices in its effort to maintain supra-competitive prices, e.g., output restrictions and information sharing. These methods are generally unobservable and/or difficult to quantify but they are likely correlated with the observed target prices. For example, the cartel's efforts to restrict output would be expected to bear a relationship to the target prices it set, with greater reductions in output associated with higher target and actual prices. For this reason, the target price index in our regression also acts as a proxy for these other methods of raising prices.

5. The cartel's price-fixing impacted the U.S.

During the class period, the U.S. was a major market for CRT finished goods; see Exhibits 46 and 47 and Footnote 225. The cartel sought to raise the price of tubes used in virtually all of these products sold in the U.S. and other regions. Because the cartel accounted for approximately 85% of CPT sales and 90% of CDT sales during the class period, it was well-situated to do so. See Exhibits 4, 5, and 11.

There are at least four routes by which tubes produced by Defendants could end up in the hands of U.S. class members:

1. Defendants manufactured CRTs in the U.S. that were then sold to U.S. producers of finished goods and consumed as TVs or monitors by American end-purchasers.
2. Defendants produced CRTs outside the U.S. that were then sold to U.S. producers of finished goods and consumed as TVs or monitors by American end-purchasers.
3. Defendants produced CRTs outside the U.S. that were then sold to foreign producers of finished goods, imported into the U.S. as TVs or monitors, and then consumed by American end-purchasers.
4. Defendants produced CRTs in the U.S. that were exported, then integrated into finished goods, and then shipped back to the U.S. for consumption.

During the class period, the geographic source of CDT and CPT finished goods that were sold in the U.S. differed. Almost all CDT and monitor production destined for the U.S. market took place in Asia while a significant portion of CPT and TV production destined for U.S. consumers took place closer to the U.S. final consumers. Regardless of the geographic path through which a

particular CRT traveled from manufacturer to end-user, the cartel caused prices paid by U.S. class members to be higher.

a) CDT

Between 1995 and 2007, Asia dominated the production of both CDTs (see Exhibits 48 and 49) and monitors (see Exhibit 50). Asia served as the main source of these products for North America,²²⁴ the world's largest monitor market for most of the class period; see Exhibit 46.²²⁵ North American tube manufacturers, limited participants in the CDT market from the start, were completely out of that business by 2003; see Exhibit 2.

As I discussed in Section VI.C.1, the cartel dominated the CDT market with a combined 88.5% market share in 1998 – a figure that grew to 100% by 2004; see Exhibit 4. Given the size and importance of the U.S. monitor market, Defendants' collusive conduct affected the prices U.S. end-users paid for CRT monitors. In fact, Defendants and other industry participants acknowledge that changes in the prices of CRTs are passed-through to U.S. end-users. See Section VIII.B.3.

Defendants exchanged information relevant to North America, including pricing and demand conditions.²²⁶

²²⁴ See, e.g.

- “THE WITNESS: Yes, as you know, CDTs are the ones that are used for computer monitors and unlike the ones used for TVs most of the global production is done in China, Korea and Taiwan, these South East Asian countries. They are produced there and exported in the form of sets. Because they were hardly produced in any other regions, I do not recall much about CDTs produced or supplied in North American region. Also because, in the case of computer monitors, globally no import duties are charged. For TV sets there's an import duty of 15 per cent. However because computer monitors are regarded as industrial products there's no duty. So instead of doing local production they were produced in countries with cost competitiveness, such as China and South East Asia for supply.” 22 March 2013, Deposition of Sang-Kyu Park, Volume III (Hereinafter “Deposition of Sang-Kyu Park, Vol. III, 22 March 2013”), at 340:2 - 17.
- “A. There wasn't much of a color display tube market in the United States. From the time I joined Hitachi in 1986 until the end there was never a market here because most of the monitor makers were in Asia.” Hitachi 30(b)(6) Deposition of Thomas Heiser, 03 July 2012, at 60:11 - 17.
- “[F]ew CDTs were produced in North America (most of the monitor production was in Asia)”. Willig, Robert D., 14 December 2012, Expert Report of Robert D. Willig, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division) (Hereinafter “Willig Report”), at ¶67.
- “Let me ask, with respect to monitor makers who were customers of Chunghwa's Fuzhou plant [in China]. Do you know if those monitor makers exported monitors with color display tubes from the Fuzhou plant into the United States? [objections omitted] THE WITNESS: Some were exported to the United States, I know that.” 28 February 2013, Deposition of Jing Song Lu, Volume II (Hereinafter “Deposition of Jing Song Lu, Vol. II, 28 February 2013”), at 241:13 - 241:22.

²²⁵ See, e.g., “The world's largest monitor market is North America, where about 20 million monitors were sold in 1995 - 40% of the world's total.” Philips, Undated, Philips Display Components Company North America Strategy Review 1996-2000, PHLP-CRT-081451 - PHLP-CRT-081491, at 1472.

²²⁶ See, e.g.,

- “Q. And why was it important for you to discuss with your competitors in one-on-one meetings U.S. market demand? [...] THE WITNESS: No matter group meeting or one-on-one meeting all the main purpose is to collect the market information. The U.S. demand is the main content for the market

b) CPT

CPT production for the U.S. market was located in both Asia and North America.²²⁷ See Exhibit 51. CRT TV production for the North American market was also based in various locations; see Exhibit 52. Importantly, as I described in my Rebuttal Report,²²⁸ North American consumer demand for CPTs and CRT televisions can only be met by NTSC-compatible CPTs – a specific broadcast standard distinct from the standards required for tubes sold to Europe, Africa, and most of Asia. Broadcast standard compatibility, and hence suitability for meeting U.S. consumer demand, is an inherent characteristic of every CPT, determined when it is being manufactured. North American TV manufacturers sourced the majority of their tubes from local CPT makers while also importing a significant portion of tubes, typically from Asia.²²⁹ In North America, imported CPTs accounted for about 15% of total CPT sales in 1995, increasing to about 25% in 2003.²³⁰

North America was a large market (see Exhibit 47), served by both domestic and foreign TV manufacturers. Imported TVs became increasingly common during the class period; as of 2003, over 60% of CRT televisions consumed in North America were imports.²³¹ Most imported TVs came from Asian countries and contained Asian tubes.²³²

information, so we have to discuss that U.S. demand. BY MR. VARANINI: Q. And was that true for both color display tubes and color picture tubes, Mr. Liu? A. Yes.” 21 February 2013, Deposition of Chih Chun-Liu, Volume III (Hereinafter “Deposition of Chih Chun-Liu, Vol. III, 21 February 2013”), at 435:10 - 435:24.

- “Q. Was U.S. market demand a factor in the prices that Chunghwa and its competitors -- was a factor in the prices that Chunghwa and its competitors set for color picture tubes? [...] THE WITNESS: Certainly it is. The end market in the U.S. would affect those distribution channels and that affect back to those brand companies and certainly back to the integrators. Integrators would come to Chunghwa and competitors concerning CRTs. BY MR. VARANINI: Q. So, Mr. Liu, would your answer be the same for both color display tubes and color picture tubes? A. The same.” Deposition of Chih Chun-Liu, Vol. III, 21 February 2013, at 420:19 - 421:10.

²²⁷ Deposition of Sang-Kyu Park, Vol. III, 22 March 2013, at 340:2 - 17.

²²⁸ Netz Rebuttal, at 52.

²²⁹ See, e.g.,

- LG Philips Displays, 2003, LPD_00014554.
- December 2003, North American TV and CRT Market Condition Report for 2003, MTPD-0083663, at 3.
- LG’s TV manufacturing plant in Reynosa, Mexico obtained at least 32% of its CPTs from Asian sources from 2005 to 2007. See LGERS sourcing.do.
- Similarly, Sanyo’s TV manufacturing plant in Forrest City, Arkansas imported at least 11% of its CPTs from Asian sources between 1995 and 2007. See SMC sourcing.do.

²³⁰ See, e.g.,

- LG Philips Displays, 2003, LPD_00014554.
- December 2003, North American TV and CRT Market Condition Report for 2003, MTPD-0083663, at 3.

²³¹ December 2003, North American TV and CRT Market Condition Report for 2003, MTPD-0083663, at 3.

²³² December 2003, North American TV and CRT Market Condition Report for 2003, MTPD-0083663, at 3.

Defendants regularly exchanged information relevant to North America, including pricing and demand conditions. The cartel met in the U.S. and cooperated on pricing of CPTs in the U.S. Samsung explained that it was “meeting with North American businesses in order to find a cooperation plan related to areas of common interest, and secure communication channels to continuously maintain such relationship” and indicated Samsung’s “North American market strategy [includes] Continuous maintenance of mutual cooperation within market.”²³³ Other meeting notes and Defendant testimony indicate that cartel members, at the very least, discussed prices of CPTs in U.S. meetings²³⁴ and expressed their desire to cooperate on pricing in the U.S.

²³³ Im, Chul Hong, 12 January 1999, North America CPT companies meeting summary, SDCRT-0002526 - SDCRT-0002528, at 2526E and 2527E.

²³⁴ See, e.g.,

- MDDA (Matsushita’s Troy, OH, CPT plant) exchanged market information “such as production capacity and the production situation, and also discussed the exchanged CRT price situation information” with Hitachi between 1998 and 2002. MDDA also discussed price information with Toshiba between 1998 and 2002. Deposition of Hirokazu Nishiyama, Vol. I, 05 March 2013, at 151:6 - 156:23.
- MDDA/MTPDA had meetings with Thomson between 2002 and 2006. At these meetings, they discussed production, capacity, and general market prices of North American CRTs including Thomson, LPD, MTPD, and SDI. Deposition of Shinichi Iwamoto, Vol. I, 07 February 2013, at 45:17 - 48:3.
- MDDA, TDDA (Toshiba Display Devices America), and Thomson met in 2003 and discussed Thomson’s sales status, North American market trends, and price status. 19 August 2003, Record of Meeting with T Company (Confidential), MTPD-0576483, at 6483E.
- An employee of Matsushita met with Samsung every three or four months while stationed in the U.S. between 2002 and 2004. They exchanged past production information and market information, including CRT prices. 05 February 2013, Deposition of Ayumu Kinoshita, Volume I (Hereinafter “Deposition of Ayumu Kinoshita, Vol. I, 05 February 2013”), at 77:11 - 79:2 and 142:10 - 143:18
- Hitachi discussed jumbo CPT prices with Philips in 2001 and planned to hold a follow-up meeting between the two companies in Detroit. Heiser, Tom, 07 March 2001, E-mail, Subject: SEMEX, HEDUS-CRT00000578, at 0578.
- Samsung met with Philips in the U.S. in 2001 and discussed competitor pricing. Samsung SDI, Im, Cheol Hong, 06 June 2001, Philips CPT meeting Report, SDCRT-0002582, at 2582E.
- Samsung Mexico met with Toshiba in Chicago in 2001. They discussed capacity utilization and current prices of 32VF and 36VF tubes. Samsung SDI, 11 October 2001, Meeting Report, SDCRT-0069086, at 9086E.
- LPD exchanged information with Samsung in the U.S. in 2002. They discussed production, capacity, and pricing. Canavan, Pat, 04 March 2002, E-mail, Subject: Information on SDI, PHLP-CRT-097351 - PHLP-CRT-097352, at 7351 - 7352.
- Samsung met with LPD in the U.S. in 2003 and discussed current and forecasted CPT prices. Samsung SDI, 10 March 2003, LPD, SDCRT-0002588 - SDCRT-0002589, at 2589E.
- Samsung Mexico exchanged information with Thomson in 2003. Thomson told SDI that there will be no additional price cutting. Kim, Woong-rae, 02 May 2003, E-mail, Subject: Exchange of Information on Thomson CRT, SDCRT-0007239 - SDCRT-0007241, at 7239E.
- Samsung met with LPD, Thomson, and MTPD at the 2004 Consumer Electronics Show in Las Vegas. The companies expressed concerns about price cuts. Samsung SDI, 07 January 2004, 2004 International CES Business Trip Report (Jan. 7 - 14), SDCRT-0005180 - SDCRT-0005189, at 5183E - 5184E.
- MTPDA met with Samsung America in 2004. The companies discussed North American supply and demand, 27VPF CPT pricing for Mexican customer PAVCA, and price increases of the 20VPF CPT.

market.²³⁵ The Defendants also indicated their North American collusion was intertwined with the cartel meetings involving their headquarters.²³⁶

Fujita, Norio, 01 April 2004, E-mail, Subject: (Please destroy after reading) SDI America, MTPD-0027035 - MTPD-0027037, at 7035E - 7036E.

- MTPDA met with LPD in 2004. The meeting notes say, “Pat [of LPD] is very determined to raise prices in the market.” Iwamoto, Shinichi, 02 April 2004, E-mail, Subject: FW: Meeting with Pat Canavan, MTPD-0025720, at 5720.
- LPD met with Samsung and Thomson at a “USA Roadshow” in 2004 and discussed CPT production. Thomson also discussed pricing policies with LPD. LG Philips Displays, November 2004, Evaluation USA Roadshow, PHLP-CRT-023515 - PHLP-CRT-023521, at 3516 - 3517.
- MTPDA exchanged information with Samsung North America in 2005. They discuss limiting MTPDA’s price cuts for its 32V [32 viewable inches] tube in order to protect the price of SDI’s 30VW [30 viewable inches, widescreen] tube. The notes also mention that the 27VPF [27 viewable inches, pure flat] has become more stable “since the three companies [Thomson/Videocon, LPD, and SDI]...are mutually not over-extending themselves”. Tsuruta, Shinichiro, 24 August 2005, E-mail, Subject: Re: SDI North America Information, MTPD-0303225 - MTPD-0303228, at 3228E.
- MTPDA exchanged information with Samsung North America in 2005. The information included production situations and market prices. Fujita, Norio, 02 December 2005, E-mail, Subject: Information Exchange with SDI North American Sales (Handle with Care), MTPD-0291761 - MTPD-0291762, at 1761E - 1762E.

²³⁵ See, e.g.,

- An e-mail from an employee at Samsung’s American branch with the subject line “Progress status of the price increase for clients in North America” reads: “Our strategy to increase the price... [Bullet] Strengthen the cooperation among CPT companies: If only SDI alone moves to raise the price, it would be more difficult to raise the price and it is more likely that we might face revenge attacks later. Thus we should move with all the other CPT companies and need assistance from the headquarters in this regard.” Oh Sung Kwon [SDI], 24 March 2000, Progress status of price increase for clients in North America, SDCRT-0079381 - SDCRT-0079383, at 9381.
- Notes from a meeting between Samsung, LG, Orion, Philips, and Chunghwa indicate that participants discussed NAFTA pricing and that “Mr. Chairman later requested [Philips] Mr. Corsino to keep contact with SDI/OEC personnel stationed in Mexico in order to exchange market and customer information.” Chunghwa Picture Tubes, LTD, 14 April 2000, Visitation Report (Submit), CHU00030995 - CHU00030997, at 0996.02E.
- Notes from meeting in the U.S. between Samsung Mexico and the president of Philips Display Components, North American region, say, “It would be good if cooperation on price among companies in the CPT industry would be considered after checking Thomson’s policy on price in the second half. It was agreed that a cooperation meeting between SDI and Philips would be held in our company’s plant in Mexico since the locations of Mexico and Brazil regions are safe, and the first meeting would be held around September 29.” Im, Cheolhong, 28 July 2000, Report on PHILIPS CPT Business Trip, SDCRT-0002506 - SDCRT-0002510, at 2506E.
- Notes from a meeting in Mexico between Samsung Mexico and the president of Philips Display Components, North American region, show that the two companies discussed maintaining and increasing the prices of 25V [25 viewable inches] and 27V [27 viewable inches] CPTs in 2001. The notes also appear to show that Philips gave SDI its entire business with Samex (TV manufacturer) in exchange for SDI reducing its tube supply to Philips TV. Samsung SDI, 29 September 2000, Philips Meeting, SDCRT-0002488 - SDCRT-0002489, at 2488E.
- An LPD e-mail describes a meeting with Samsung and Toshiba. Regarding the 34”RF [real flat] tube, the meeting description says, “Toshiba USA ... will increase its output, decreasing [curved screen] production.

They say they sell it at US\$330 and have no intention to drop the price. Their first priority customer is Toshiba-TV. I strongly talked them that there is no reason to reduce its price to such a low level. => Our MK-II of Gomez [in Mexico] should have cost competitiveness". Philips, Lee, Phil PJ, 30 May 2002, E-mail, Subject: Information for SDI and Toshiba, PHLP-CRT-014272, at 4273.

- From an internal Matsushita e-mail: "Regarding the above-captioned matter, there was a telephone call from Toshiba CRT today (Mr. Sanogawayaya took the call), and information regarding the North American market for 32 V [32 viewable inches] was exchanged. During this conversation, it was mentioned that there is a shortage of 32V product and the price is not going to decline as the year comes to a close, so [Toshiba] would definitely like to have [us] maintain the price. [Toshiba] is particularly concerned about the Sharp price, and they also know that MDDA obtained the Sharp Project, and [we] were told regarding the price that they would like for us not to lower the price more than the offering price even if Sharp requests it." Yasuki, Tomori, 13 June 2002, E-mail, Subject: New Document, MTPD-0024384, at 4384E.
- Notes from a meeting between Samsung, LPD, and Toshiba indicate that Samsung is "[s]eeking the cooperation with LPD in the US". SDI was planning to contact LPD in Mexico and meet with LPD's Chief Sales Officer at the Consumer Electronics Show in the U.S. Samsung SDI, 06 December 2002, 3 Companies MTG Information (5th) - Result Report, SDCRT-0087934 - SDCRT-0087937, at 7937E.
- A trip schedule shows Samsung Mexico meeting with LPD and Thomson's CPT division on 10 March 2003, probably in San Diego, regarding "Americas market cooperation and information exchange". SDI Mexico was meeting with MDDA the following day. Samsung SDI, 26 February 2003, Mexico Trip Schedule, SDCRT-0076954 - SDCRT-0076956, at 6954E.
- This schedule is an attachment to an e-mail that says, "3/3 - 3/11 (9 days): Visit with major customer and competitor companies.... Competitor companies: LPD, Thomson, Matsushita (Americas market collaboration and information exchange)." Oh, Kyung Chul, 26 February 2003, E-mail, Subject: Mexico Corporation Business Trip Schedule (Transition), SDCRT-0076953, at 6953E.
- Notes from SDI's meetings with LPD, Thomson, and MTPD at the 2004 Consumer Electronics Show in Las Vegas say, "Competitors are having trouble in operating lines and indicated great concern about the price cut of large and jumbo sized models. They are desperately seeking collaboration among the companies for survival." Samsung SDI, 07 January 2004, 2004 International CES Business Trip Report (Jan. 7 - 14), SDCRT-0005180 - SDCRT-0005189, at 5185E.
- An MTPD e-mail describes meeting with Thomson and LPD at the 2004 Consumer Electronics Show in Las Vegas: "Please note that we met with competitors (Thompson, LPD) as well, but the points were that (1) price should be maintained (2) operations in Europe and America are tough and (3) we should move forward with mutual non-aggression with regards to captives." Iwamoto, Shinchi, 14 January 2004, E-mail, Subject: RE: Opinions-- CE Show, MTPD-0042738 - MTPD-0042740, at 2739E.

²³⁶ See, e.g.,

- "Based on December meeting at headquarters, there was a subsequent meeting for purposes of finding grounds for cooperation within the North American market..." Im, Chul Hong, 12 January 1999, North America CPT companies meeting summary, SDCRT-0002526 - SDCRT-0002528, at 2527E.
- "Thus we should move with all the other CPT companies and need assistance from the headquarters in this regard." Oh Sung Kwon [SDI], 24 March 2000, Progress status of price increase for clients in North America, SDCRT-0079381 - SDCRT-0079383, at 9381
- "I think we can move the negotiation for CPT price forward with advance due to tight demand and supply caused by shortage of bulbs. However, because the market will not turn around when only our company precedes, I think it is important to create an atmosphere 'CPT price will increase??' in the market. [break] ** I am thinking of starting to make the atmosphere of 'CPT price going up next year??' due to shortage of bulbs by visiting TV clients here from May to June. ** I request Headquarter to obtain information of the status of demand and supply of bulbs in the next and following years from Bulb suppliers. (Particularly, in each region) I also want to ask TDD [Toshiba Display Devices in Horseheads, New York] to obtain the expected status of demand and supply of bulbs in North America from local Bulb suppliers. ** I also want

Defendants' North American and other subsidiaries sought pricing guidance and approval from Defendants' headquarters in Asia. Indeed, there is significant evidence that many Defendants' headquarters were able to influence, or even set, the prices at which their North American and other subsidiaries sold CPTs to customers.

For example, pricing decisions at Chunghwa's subsidiaries were controlled by headquarters in Taiwan (specifically, by C.C. Liu) for its sales to North America and other regions.²³⁷ LG's headquarters provided price guidelines for its North American and other regional subsidiaries.²³⁸ LPD's Chief Sales Officer at headquarters provided global price guidelines to its regional sales offices.²³⁹ Pricing at MTPD's North American and other regional subsidiaries was done

to request Headquarter to contact competitive manufacturers of CPT (MEC [Matsushita], HITACHI, Sony) to know their directions for taking measures in North America next year." Tukunaga, Seiichi, 12 May 2000, E-mail, Subject: A scenario expecting shortage of cpt bulb (?) in North America, TSB-CRT-00039194 - TSB-CRT-00039196, at 9195E.

- An LPD internal e-mail about a meeting among LPD, Samsung, and Toshiba concludes "Dear AM [Americas] and EU colleague, Please let me know if there is anything we have to talk with SDI and Toshiba at global level. We will get together comming [sic] July in Japan. And I can keep in touch with them from time to time by mail or phone." Philips, Lee, Phil PJ, 30 May 2002, E-mail, Subject: Information for SDI and Toshiba, PHLP-CRT-014272, at 4273.

²³⁷ See, e.g., quotes from employees at Chunghwa's Malaysian branch:

- "A. At that period of time I was responsible for the sales of CPTs in Malaysia. Regarding CDTs, we simply handled services in accordance with the head company's instructions. Q. During this period of time, did you have pricing authority? A. Mostly, yes. Q. Did you have final pricing authority? A. Not always. I have some authorities. Regarding others, I have to consult with the headquarters. Q. In what situation would you have the final price authority? A. After consulting the headquarters and obtaining a range, within that range I have -- I had the final say. Q. Who would provide you with that pricing range? A. C.C. Liu." 22 February 2013, Deposition of Sheng-Jen Yang, Volume I (Hereinafter "Deposition of Sheng-Jen Yang, Vol. I, 22 February 2013", at 32:16 - 33:9.
- "Q. Did you [have] any duties or responsibilities with respect to the negotiation of prices with Chunghwa's customers for either CDTs or CPTs in this position? A. Yes, part of it. Q. Okay, can you describe those particular duties and responsibilities that you performed in that position? A. Are you asking all those job responsibilities or only those related to sales? Q. Only those related to sales. A. Because Chunghwa's Headquarters still control the pricing, so all the pricing for major customers were controlled by the Headquarters or decided by the Headquarters. For some small local customers I could make decisions. Q. And in this position, in the Malaysia plant, who did you directly report to? A. Mr. Tony Cheng, C-H-E-N-G, and C.C. Liu." 27 February 2013, Deposition of Jing Song Lu, Volume I (Hereinafter "Deposition of Jing Song Lu, Vol. I, 27 February 2013", at 19:18 - 20:12.

²³⁸ A slide titled "Comparison of HQ's sales functions between AP [Asia Pacific] and Other regions" from an LG presentation indicates that LG's headquarters handled all aspects of sales for the Asia Pacific, and handled price guidance, allocation, and inter-regional sales coordination for America, Europe, and China. A later slide titled "A/P Sales Mission & Roles" from an LG presentation lists "Regional Price Decision in line with Global Price Guidelines" as one of the roles of LG's Asia Pacific sales organization. Undated, AP Sales Organization (Draft), LGE00009918, at 5-6.

²³⁹ See, e.g.,

- A "Demand Generation Process" document from LPD headquarters indicates that the CSO [Chief Sales Officer] at headquarters is the "final decision maker" in preparing global price guidelines per product size and communicates guidelines to Key Account Managers and regions. LG Philips Displays, 02 April 2003, Demand Generation Process, FOX00034021 - FOX00034082, at 29-31.

according to business plans created by top management at headquarters,²⁴⁰ and regional price quotes needed approval from headquarters whether they were below or above the business plan bottom prices.²⁴¹ Philips had “Commercial Council Meetings” of regional CPT marketing and sales managers to discuss, among other things, pricing policies in North America and other regions.²⁴² Philips documents also show regional subsidiaries receiving price guidance from

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- From an LPD presentation slide titled “Roles in the organization”: “Headquarter Functions in CSO [Chief Sales Officer] [Bullet] CSO leadership and integration of global plans across functions [Sub-bullet] Global allocation (co-op with COO) [Sub-bullet] Global pricing (global sales co-ordination, CFO analysis, COO cost structures, BI) [Bullet] Global business development [Sub-bullet] Align/co-ordinate customer account plans and policies.” LG Philips Displays, 12 April 2005, LPD sales organization focus on global account management, PHLP-CRT-009518, at 7, emphasis added.

²⁴⁰ “[Q.] Who’s in charge of setting the bottom price? A. I’m not sure if I’m answering your question the -- precisely, but as I mentioned, the idea about the price is submitted by the sales, and the other departments or divisions submit their numbers, too. And after all of those are authorized, then the -- in the end, the price that appears in the authorized plan becomes the -- that bottom price. And the business plan itself is approved by the top management of the MTPD.... Q. Okay. And who -- so who is it that uses all this information to set the bottom price? Is it the company’s top management? A. Top management approves the entire business plan, and since the price is a part of it, in that sense you could understand that the top management is the one who approves the -- approves it too.” 17 July 2012, Deposition of Panasonic Corporation, Panasonic North America and MTPD 30(b)(6) Witness Hirokazu Nishiyama, Volume I (Hereinafter “Panasonic 30(b)(6) Deposition of Hirokazu Nishiyama, Vol. I, 17 July 2012”), at 71:2 - 71:25.

²⁴¹ See, e.g.,

- According to an MTPD document, MTPD’s new product prices must be approved by the President of MTPD (Mr. Tobinaga) if the decision may affect the whole MTPD group operation. Other new product prices must be approved by the Director of the Operation Business group (Mr. Shimoma). MTPD’s current product prices must be approved by the Director of the Operations Business group (Mr. Shimoma) and the Director of Regional Division (Mr. Matsuda for MTPDA and MTPDG, Mr. Shimoma for Asian companies) if the offered price is lower than business plan. If the offered price is within the business plan, current product prices must be approved by the Director of Regional Division (Mr. Matsuda for MTPDA and MTPDG, Mr. Shimoma for Asian companies). MTPD, 05 October 2004, Request for cooperation to MTPDG, MTPD-0400021.
- “Q. BY MR. LAMBRINOS: If the salesperson doesn’t think he can -- he or she can get the business at the bottom price, can he depart from the bottom price and go below it? A. Yes. Q. What would the procedure have been for such a thing? A. In case it was not possible to get a business without offering the price that was below the price in the business plan, and if that business is an important business, then the salesperson could start what’s called the price -- price decision form and obtain the top management’s approval.” Panasonic 30(b)(6) Deposition of Hirokazu Nishiyama, Vol. I, 17 July 2012, at 77:16 - 78:14.
- A pricing approval form from MTPD (Indonesia) shows seals of approval from high-ranking managers at MTPD headquarters. MT Picture Display, Undated, Approval of Sales Price, MTPD-00653133 at 3133.
- Mr. Nishimaru of MTPD (Thailand) testified that he had to consult Mr. Nishiyama at headquarters when making price responses: “Q. Did Mr. Nishiyama have pricing authority for CRTs? [objection omitted] THE WITNESS: The image wasn’t -- or the -- the image was not that Mr. Nishiyama had pricing authority on his own. BY MS. ROSENBERG: Q. He had some responsibility for pricing? [objection omitted] THE WITNESS: I think he was one of the people who needed to be consulted when making price responses. However, I don’t have the impression that Mr. Nishiyama had pricing authority.” 27 June 2013, Deposition of Kazuhiro Nishimaru, Volume II (Hereinafter “Deposition of Kazuhiro Nishimaru, Vol. II, 27 June 2013), at 233:17 - 234:8.

²⁴² See, e.g.,

headquarters.²⁴³ Samsung headquarters provided price guidelines for its North American and other regional subsidiaries in the form of a three-month rolling profit-and-loss plan;²⁴⁴ prices below the rolling plan's target prices had to be approved by headquarters.²⁴⁵ Toshiba

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- From a Briefing Strategy Review: "The 'Smart' project is aimed at improving our competence in all key processes at the customer interface. This has to result in a more proactive product policy integrated with the needs of our key customers. This also requires a consistent policy w.r.t. [with respect to] customer portfolio, target marketing and pricing policy.... The nature of other global accounts such as Sharp and JVC and Sanyo needs to be better understood, in so far as it affects global/regional purchasing decisions. Nevertheless, a more transparent overview of key global/regional accounts will be followed up in the next Commercial Council." Wilkes, John, 05 February 1999, Subject: Strategy Review 1999 - 2003, FOX00050659 - FOX00050689 at 4.
 - An action plan from an October 2000 Commercial Council Meeting shows a due date of November 2000 for "Global TVT [TV tubes (CPTs)] pricing analysis + Guidelines [sic]". Philips, 26 October 2000, Action List Commercial Council Meeting October 26/ 27 in Amsterdam, PHLP-CRT-029673 - PHLP-CRT-029674, at 9674.

²⁴³ See, e.g.,

- From an internal e-mail concerning price quotations from Philips' Singapore sales office to customer LoBTV: "These prices are based on DC [headquarters] view of AP market price, which has been reviewed with all regions via Anton [from headquarters], where as in the price agreement it is stated that we would use LoBTV input for the market price." Tyson, Mike, 15 April 1998, E-mail, Subject: LoBTV Asia Pacific Price quotation for Q2., PTC-00008572 - PTC-00008573, at 8572.
- A February 1999 e-mail from Philips headquarters to regional managers has price guidelines for 14" and 20" CPTs for Asia Pacific, North America, Europe, and South America. Philips, Undated, EIN0109551, EIN0109551 - EIN0109996, at 9841 - 9842.
- Philips Display Components (PDC) North America is subject to global pricing policy for its strategic account, which is PCEC (Philips Consumer Electronics). PCEC accounted for over 40% of PDC North America sales in 1999. Philips, September 1999, Philips Display Components Company NAFTA Sales Strategy, PTC-00001149, at 9 - 10, 27.

²⁴⁴ See, e.g.,

- "Q. Was – was the dispatched employee giving any sort of guidelines as to how to price a product, or was this employee allowed to do whatever they wanted? [objection omitted] THE WITNESS: There are like midterm or long-term goals in our company, in our company's operation plans. So as I mentioned, we have a target for each three months. And we call it the rolling plan, and we have a target in terms of profit and loss. So if the goal – the target can be met, then decisions can be made locally in the region. But if the customer's demand in terms of pricing is so – is [too low] to be dealt with locally or that local market fluctuated so much and that it affects the profit and loss to the extent the local dispatched employee cannot handle, then – then that dispatched employee would check with the headquarters and have a discussion and – discussion, and then a decision will be made." Samsung SDI 30(b)(6) Deposition of Jaemin Lee, Vol. II, 07 June 2012, at 186:4 - 186:25.
- A Samsung user manual for creating rolling plans shows that local sales members input prices and headquarters sales members confirm the prices. Samsung SDI, August 2005, APS Rolling Plan User Manual (Functional), SDCRT-0054114, at 1.
- An internal Samsung e-mail shows that the plants enter CPT/CDT quantity and price into the rolling plan, and then headquarters adjusts quantity and price as needed. Choi, Jinyong, 13 May 2007, E-mail, Subject: '07.MAY Rolling Plan SKDL('07.MAY - '07.DEC), SDCRT-0033533 - SDCRT-0033534, at 3533.

²⁴⁵ See, e.g.,

- "Q. All right, during 1996 through 1999 when you were selling CPTs and CDTs, produced in the Malaysian plant, who had the final authority to set – to approve the prices at which you would make sales?

headquarters consulted on North American and other regional pricing decisions and provided price plans for its regional subsidiaries through its CPT Overseas Sales Group.²⁴⁶ This evidence of centralized pricing at the Asian headquarters, in combination with the rest of my analyses, means that the cartel influenced the prices of CPTs and CRT TVs sold in the U.S.

Defendants were well aware that their actions in Asia, North America, and elsewhere directly impacted pricing of both CPTs and CRT TVs that were produced or consumed in North America.²⁴⁷

[objections omitted] THE WITNESS: To explain more specifically about this they – there could be various cases. For instance, let’s say that I met a customer who asked for a price discount. If the depth of the price discount is at a level that I can decide on I might make a decision to give the discount, but if it’s too deep I could report it to the general manager in charge of sales at the headquarter or in any other – in other cases, if sales people below me meet with customers and those customers ask for a price discount and that is at that level that could be determined or decided by those people themselves, they could make that decision themselves. So, there could be various instances and possibilities which is why it is difficult for me to tell you exactly one person who makes the decision.” 20 March 2013, Deposition of Sang-Kyu Park, Volume I (Hereinafter “Deposition of Sang-Kyu Park, Vol. I, 20 March 2013”), at 33:2 - 34:1.

- “Q. So in those instances where there’d be requests for, I think you termed it excessive pricing, excessive price drop, the process was for the dispatched employee to contact someone at headquarters regarding that customer’s request; is that accurate? A. Yes, that’s correct. Q. Was there a particular contact person at headquarters during the period 1998 to 2006 who dealt with questions like that? [objections omitted] THE WITNESS: Basically when you look at our company’s organization, it’s done by the customer. So – and in here, too, in North America and Mexico there is – there is a person who is in charge of the customers, so the – the person at the headquarters who was in charge of the customer would be contacted. But if the price drive is too hard and the price has to go down too much, then the discussion will be made with the CPT team leader.” Samsung SDI 30(b)(6) Deposition of Jaemin Lee, Vol. II, 07 June 2012, at 277:2 - 22.

²⁴⁶ See, e.g.,

- “[Q.] At Toshiba Thailand, what was the process for setting prices for CDTs while you were there? ... A. Here again, there were many different cases. There were times when -- when the decision was made in consultation with my superior, cases where the president of TDDT would be consulted, and in parallel there are cases where consultation occurred with the sales group, CRT sales group in Japan. There are different cases.... BY MS. ROSENBERG: Q. At some point you also took responsibility and were involved with CPT sales, correct? [objection omitted] THE WITNESS: I became in charge of CP -- in charge of the sales of CPTs at TDDT in January of 2003.... Q. In any event, when you became involved with CPT sales in 2003, is it your recollection that pricing decisions were made similarly to the decisions that -- the way decisions were made about pricing CDTs? [objection omitted] THE WITNESS: I think so.” 26 June 2013, Deposition of Kazuhiro Nishimaru, Volume I (Hereinafter “Deposition of Kazuhiro Nishimaru, Vol. I, 26 June 2013”), at 82:21 - 87:20, emphasis added.
- An organization chart for Toshiba headquarters shows a CPT Overseas Sales Group. It indicates that the deputy manager for this group is responsible for the budget, forecast, midterm plan, and price control for America, Europe, Asean, the Middle East, and East Asia, as well as sales support for TDD, TDD (Thailand), and TDD (Japan). 01 October 2001, Organization of CRT Sales & Marketing Dept., TAEC-CRT-00084530, at 4530.0002.

²⁴⁷ For example, notes from an October 27, 1999 meeting read: “Price-up trend [of small and medium CPTs] in European & American market thanks to capacity reduction in Asia.” Chunghwa Picture Tubes and LTD, 27 October 1999, Visitation Report, Topic: Exchange of Market Information and Price Review, CHU00030899 - CHU00030903, at 0902E. For context, see, e.g.,

- Notes from a 26 September 1998 meeting, “In order to stabilize price for this over-supplied market, a simulated adjustment of each maker’s Q4 [1998] production volume plan is as follows.” The notes then

B. The cartel overcharge was passed on to class members

Above I showed that the impact of the cartel was to raise the price of tubes to direct customers; that is, direct customers were harmed by the cartel by paying higher prices for CRTs than they otherwise would have. In order for class members (end consumers) to have been harmed by the cartel via higher prices for CRT products, at least some portion of the overcharge imposed on direct purchasers must have been passed down the distribution chain to class members.

To determine whether cartel CRT prices were passed through to indirect purchasers, I first reviewed the economic theory of pass-through. Next, I reviewed documentary evidence that showed that Defendants expected resellers of CRT products to pass through cost changes. These documents also established that Defendants routinely monitored the street, or retail, prices of CRT products. Street price monitoring underscores that Defendants were aware of the connection between the tube price charged to direct purchasers and the amount paid by class members for computer monitors and TVs that contain tubes.

My review of these materials led me to conclude that at least some portion of the cartel overcharge was passed through to class members: CRT product prices (i.e., the amount class members pay) increase when CRT prices (i.e., the amount direct purchasers pay) increase. In other words, all class members were harmed by the cartel. I conducted 62 studies to quantify the magnitude of pass-through; see Section X. Those results – that every pass-through estimate was 100% or more – are further support for my conclusion here that the overcharge was passed through to class members.

1. Economic theory supports pass-through of the cartel overcharge

Economists routinely study the impact of changes in costs (in this case, a change in the cost of a CRT) on prices (in this case, the price of a product containing a CRT) theoretically and empirically. Economists refer to the concept of changes in upstream costs leading to changes in downstream prices as “pass-through” (also sometimes called “pass-on”). The pass-through rate

detail the quantity reductions of 14" and 20"/21" CPTs for each maker. Chunghwa Picture Tubes and LTD, 26 September 1998, Visitation Report, Topic: 14"/20"/21" CPT Supply/Demand and Price Comment Review, CHU00029262 - CHU00029264, at 9264.01E.

- Notes from a 27 November 1998 meeting, “In an overall view of Q1 [1999], all makers are taking action to reduce production according to order status so no further discussion was conducted on this topic.” The targeted products are 14", 20", and 21" CPTs. Chunghwa Picture Tubes and LTD, 27 November 1998, Visitation Report (Submit), CHU00029259 - CHU00029261, at 9261.01E.
- Notes from a 20 May 1999 meeting describe the number of production lines reduced by each maker for 14" and medium-sized CPTs in Q1 1999. Supply and demand forecasts show overcapacity declining as the year progresses. Chunghwa Picture Tubes and LTD, 20 May 1999, Meeting Minutes, Meeting Subject: CPT Top Management Meeting, CHU00029191 - CHU00029194, at 9193E.
- Notes from a 24 January 2000 meeting indicate that 14" CPT capacity was reduced 5.1% in 1999 and 20"/21" CPT capacity was reduced 9.8% in 1999. Chunghwa Picture Tubes and LTD, 24 January 2000, Visitation Report, CHU00029152 - CHU00029154, at 9153E.

quantifies the degree to which output prices change when costs change.²⁴⁸ For example, a pass-through rate of 110% means that when costs increase by \$1, prices increase by \$1.10.²⁴⁹

Pass-through can occur at each stage of the manufacturing and distribution process. As an example, consider gasoline. An increase in the price of crude oil, the primary input into gasoline, can cause an increase in the price of wholesale gasoline, which can cause an increase in the rack price of gasoline (the amount paid by gas stations), which, in turn, can cause an increase in the price of gasoline at the pump. Scholarly studies have shown that changes in the cost of crude oil (at the top of the distribution channel) are passed-through to consumers of gasoline (at the bottom of the distribution channel).²⁵⁰

A fundamental result in economics is that firms increase price when faced with an increase in cost. The incentives to increase price in response to a cost increase are stronger when the cost increase affects more of the firms that purchase the product, the longer the cost increase is expected to last, and the higher is the cost increase. Pass-through occurs regardless of the market structure of the industry facing the cost increase. While the magnitude of pass-through depends on the market structure and the shape of demand for the product, pass-through occurs.

²⁴⁸ E.g., if a \$50 increase in cost causes price to increase by \$55, then the pass-through rate is 110% ($\$50 \times 110\% = \55). Mathematically, the pass-through rate is the partial derivative $\partial p / \partial c$, where p represents price and c represents cost.

²⁴⁹ There is another relationship between cost and price that is sometimes confused with pass-through called mark-up. The mark-up rate refers to the average relationship between cost levels and price levels. It is calculated as total price divided by total cost. The mark-up rate is a relationship between price and cost levels, and the pass-through rate refers to the relationship between cost and price changes.

²⁵⁰ See, e.g.,

- Balke, N.S., S.P.A. Brown, and M.K. Yucel, 1998, Crude Oil and Gasoline Prices: An Asymmetric Relationship?, Federal Reserve Bank of Dallas Economic Review, 2-11.
- Blair, Benjamin F. and Philip A. Mixon, June 2011, Price Pass-Through in U.S. Gasoline Markets, Working Paper.
- Chouinard, Hayley H. and Jeffrey M. Perloff, 2007, Gasoline Price Differences: Taxes, Pollution Regulations, Mergers, Market Power, and Market Conditions, The B.E. Journal of Economic Analysis & Policy Vol. 7 Iss. 1.
- Dale, Charles, John Zyren, et al., February 1999, Price Changes in the Gasoline Market: Are Midwestern Gasoline Prices Downward Sticky? Energy Information Administration.
- Godby, R., A.M. Linter, et al., 2000, Testing for Asymmetric Price Responses in the Canadian Gasoline Market, Energy Economics, Vol. 22, 349-368.
- Kirchgassner, Gebhard and Knut Kubler, 1992, Symmetric or Asymmetric Price Adjustments, Energy Economics, Vol. 14, 171-185.
- Radchenko, Stanislav, 01 June 2005, Lags in Response of Gasoline Prices to Changes in Crude Oil Prices: The Role of Short-Term and Long-Term Shocks, Energy Economics, 27, 573 - 602.
- Reilly, B. and R. Witt, 1998, Petrol Price Asymmetries Revisited, Energy Economics, Vol. 18, 297-308.
- Shin, David, December 1992, Do Product Prices Respond Symmetrically to Changes in Crude Prices?, American Petroleum Institute, Research Study #068, 137-157.
- Weinhausen, Jonathan, July 2003, Consumer Gasoline Prices: An Empirical Investigation, Monthly Labor Review, Vol. 126(7), 3-10.

a) Pass-through in a textbook model of perfect competition

The textbook definition of a perfectly competitive market is one in which there are many buyers and sellers, none of which can affect prices in any significant manner. There are no barriers to entry or exit, so firms can enter or exit the market freely. Buyers and sellers have perfect information; that is, they have perfect knowledge of product quality, price, and availability. The products being sold are homogeneous goods, meaning there is no difference in quality (perceived or actual) between various suppliers and thus buyers buy from the cheapest source. Neither buyers nor sellers incur any transaction costs when exchanging goods.²⁵¹ These conditions mean that sellers in a perfectly competitive market can instantaneously react to any changes in cost, regardless of whether the change is temporary or whether it is small. That is, sellers can make perfect adjustments to respond to market changes. Under these textbook conditions, economic profits are zero in the long-run.²⁵² If economic profits were negative, firms would go out of business, causing prices to rise until economic profits returned to zero; if economic profits were positive, firms would enter, causing prices to decline until profits returned to zero.

Now consider an industry-wide cost increase that impacts all of the perfectly competitive firms. Any perfectly competitive firm that did not pass through the higher input costs would earn negative economic profits on all its sales, since its costs would be greater than its price, and would eventually go out of business. Not passing through cost increases would mean the firm would lose money on each unit sold, which is not a rational long-term strategy for a profit-maximizing firm.²⁵³ Thus, all perfectly competitive firms would charge a price that covered the increase in cost. An industry-wide cost increase results in higher prices across the board.²⁵⁴

Now consider a cost change that is not industry-wide. If one of the perfectly competitive firms faced with the cost increase raises its price, it will lose all its sales; its customers will all switch to firms that do not face the cost increase and that are therefore continuing to charge the original price. In this case the firm will go out of business, which is also what it would do if it kept charging the original price, because its costs would be greater than its revenues.

Suppose that the perfectly competitive market also displays an economic characteristic known as “constant costs”, which means the market can grow to any size without driving up the costs of its

²⁵¹ Agriculture markets are often considered nearly perfectly competitive. In the market for wheat, for example, there are thousands of sellers (farmers producing wheat) and thousands of buyers who produce flour and other products. In the wheat market, no individual seller or buyer can significantly affect the price of wheat. Pindyck, Robert S. and Daniel L. Rubinfeld, 2005, *Microeconomics: Sixth Edition*, Prentice Hall: Upper Saddle River.

²⁵² A firm’s profitability can be measured using either accounting profit or economic profit. Accounting profit is a firm’s revenues minus the total costs of producing goods or services including labor, raw materials, and interest plus depreciation expenses. Economic profit is a firm’s total revenue minus the total opportunity cost of the inputs. Therefore, economic profits, unlike accounting profits, consider the return a firm would earn if its capital were used elsewhere. Pindyck, Robert S. and Daniel L. Rubinfeld, 2005, *Microeconomics: Sixth Edition*, Prentice Hall: Upper Saddle River, at 283.

²⁵³ Firms may elect to temporarily sell products below cost. See Section VIII.B.1.b)(5) for a discussion of why these pricing aberrations are not inconsistent with positive pass-through.

²⁵⁴ Pass-through is zero under perfect competition in the unrealistic case where demand is perfectly elastic. Perfectly elastic demand falls to zero if price increases at all, even by a penny. If demand were perfectly elastic and costs increased, all firms would go out of business and the market would disappear because the value of the good (how much consumers are willing to pay for it) is less than the cost of producing the good.

inputs.²⁵⁵ In this case, the long-run pass-through rate of an industry-wide cost increase is 100%, which means that if costs rise by \$1, prices also rise by \$1.

Economic theory establishes that when an industry is perfectly competitive, the pass-through rate of an industry-wide cost increase is positive;²⁵⁶ and, when the industry displays constant costs, the pass-through rate is 100%.²⁵⁷

b) Pass-through in the real world

As explained above, economic theory establishes that under the extreme conditions of a constant cost, perfect competition, industry-wide cost changes are completely passed-through. Similarly, under these extreme conditions, cost increases that are not industry-wide cannot be passed-through at all; firms experiencing the cost increase ultimately go out of business, firms not experiencing the cost increase survive, and price remains the same. While the textbook conditions of perfect competition are informative to understanding the actual world, no industry—including that for the production and distribution of CRT products—is perfectly competitive; therefore, in the real world, pass-through is not a binary construct where the pass-through rate is either 0% or 100% depending on whether the cost change is strictly industry-wide or not.

Markets also generally deviate from perfect competition in that there is not perfect information, zero transactions costs, and no barriers to entry or exit. Given these deviations from the textbook perfectly competitive model, prices may not be uniform across all products, firms, consumers, and time. Pass-through is fully consistent with a variety of pricing practices that may be present in the distribution of CRTs and CRT products. Specifically, pass-through occurs even when firms have some influence on price, it is costly to change prices, cost changes are non-transitory, there are multiple levels to the pass-through channel, there is price variation across firms and/or products, there is loss-leader or discount pricing, or there is focal point pricing.

(1) Pass-through when firms have influence on price

Imperfectly competitive or oligopolistic markets deviate from textbook models of perfect competition or monopoly in a variety of ways. The most obvious deviation is in terms of the number of competitors: there are not so many firms that each firm has no individual influence on price and there is more than one firm. With imperfect competition, the pass-through rate for

²⁵⁵ For example, if unskilled labor is a major input in a firm's production, and the wage for unskilled laborers is unaffected by the increase in demand, then the firm can expand without incurring any cost increases. A practical example is if a new retail store opens in a large city, the new entrant pays the same wage as existing retail stores—the prevailing wage for store clerks remains unchanged.

²⁵⁶ See, e.g.,

- Bishop, Robert L., May 1968, The Effects of Specific and Ad Valorem Taxes, *Quarterly Journal of Economics*, Vol. 82(2), 198-218.
- Kosicki, George and Miles B. Cahill, Fall 2006, Economics of Cost Pass Through and Damages in Indirect Purchaser Antitrust Cases, *Antitrust Bulletin*, Vol. 51(3), 599-630.

²⁵⁷ Nicholson, Walter, 2005, *Microeconomic Theory: Basic Principles and Extensions: Ninth Edition*, South-Western: Mason, Ohio, at 296-299 and Stiglitz, Joseph E., May 1988, *Economics of the Public Sector*, 2nd edition, W.W. Norton & Company, at 417.

industry-wide cost increases is positive.²⁵⁸ An imperfectly competitive firm recognizes that, when it shifts even a portion of its cost increase forward, the increase in price causes demand for its product to decline. Depending on how responsive demand is to changes in price, an imperfectly competitive firm may find it profitable to shift forward less or more than its cost increase;²⁵⁹ that is, the pass-through rate may be less than or greater than 100%, respectively.²⁶⁰

²⁵⁸ Fullerton, Don, and Gilbert E. Metcalf, 2002, Chapter 26: Tax Incidence, in Auerback, A.J. and M. Felstein (Eds.), *Handbook of Public Economics*, Vol. 4, Elsevier Science: Amsterdam, at 1823.

²⁵⁹ When a firm increases its price in response to a cost increase, there are two effects on profits: (1) the firm's profit on each unit sold changes and (2) the firm sells fewer units. While the second effect always causes the firm's profits to fall, the first effect may cause the firm's profit per unit sold to rise or fall. The decline in sales is sufficient that the firm's profits always fall when costs increase; the firm mitigates the extent of the profit decline by increasing its price.

Suppose that a firm passes through less than 100% of a cost increase. In that case, its profit on each unit sold declines and it sells fewer units, but the loss in sales is smaller than it would be if the firm passed on 100% or more of a cost increase. When the firm is earning economic profits, the firm can account for the higher costs in part by passing some of the cost increase on to consumers and in part by reducing its profit margin. If a firm passes through more than 100% of a cost increase, then it still sells fewer units, but its profit on each unit sold increases. The increase in profits per unit mitigates the decline in profits caused by the decline in volume sold. The pass-through rate is less than 100% when the change in price reduces quantity sufficiently that it would offset the increase in profits per unit if price rose by more than the cost change. Fullerton, Don and Gilbert E. Metcalf, 2002, Chapter 26: Tax Incidence, in Auerback, A.J. and M. Felstein (Eds.), *Handbook of Public Economics*, Vol. 4, Elsevier Science: Amsterdam, at 1825.

²⁶⁰ Empirical studies have found positive pass-through rates of less than, greater than, and equal to 100%. I am aware of no study published in a peer-reviewed journal that has found a pass-through rate of zero.

For estimates of pass-through rates less than 100%, see, e.g.,

- Balke, N.S., S.P.A. Brown, and M.K. Yucel, 1998, *Crude Oil and Gasoline Prices: An Asymmetric Relationship?*, *Economic Review*.
- Delipalla, Sophia and Owen O'Donnell, 2001, *Estimating Tax Incidence, Market Power and Market Conduct: The European Cigarette Industry*, *International Journal of Industrial Organization*, 19, 885 - 908.
- Duffy-Deno, K.T., 1996, *Retail Price Asymmetries in Gasoline Local Markets*, *Energy Economics*, Vol. 18.
- Nakamura, Emi and Dawit Zerom, 2010, *Accounting For Incomplete Pass-Through*, *The Review of Economics and Statistics*, Vol. 77, No. 3, 1192-1230.

For estimates of pass-through rates greater than 100%, see, e.g.,

- Carbonnier, Clement, 2013, *Pass-through of Per Unit and ad Valorem Consumption Taxes: Evidence from Alcoholic Beverages in France*, *The B.E. Journal of Economic Analysis & Policy*.
- Doyle, Maura P., July 1997, *The Effects of Interest Rates and Taxes on New Car Prices*, Board of Governors of the Federal Reserve System Finance and Economics Discussion Series 1997-38.
- Karp, Larry S. and Jeffrey M. Perloff, 1989, *Estimating Market Structure and Tax Incidence: The Japanese Television Market*, *Journal of Industrial Economics*; Vol. 37(3), 225-239.
- Young, Douglas J. and Agnieszka Bielinska-Kwapisz, March 2002, *Alcohol Taxes and Beverage Prices*, *National Tax Journal*, 55(1), 57 - 73.

For estimates of pass-through rates equal to 100%, see, e.g.,

In imperfectly competitive markets, if a cost increase is imposed on some, but not all, resellers, it will be more difficult to pass-through those increases, but it will not be impossible as it is when a market is perfectly competitive. When the reseller passes through the cost change, at least some purchasers will choose to buy from those resellers that did not experience a cost increase and which can therefore charge a lower price than those firms that do face the cost increase. If the cost increase is industry-wide, resellers know that they can pass-through a larger portion of the cost increase because all other resellers will also increase prices. Therefore, as the cost increase becomes closer to industry-wide, the pass-through rate will approach 100% for all resellers.

(2) Pass-through when there is a cost to change price

In a perfectly competitive industry, there are no transaction costs, so prices can be instantaneously adjusted to account for cost changes no matter how small or how temporary they might be. In the real world, firms do face transaction costs. One type of transaction cost a firm may face is a cost to changing its price. For example, typically a restaurant that changes prices will need to print new menus. Economists call the cost of changing prices “menu prices”, from this restaurant example. The costs associated with changing prices, referred to by economists as menu costs, include, but are not limited to, re-pricing merchandise, changing displays, and communicating the new prices to salespeople.

Thus, when a firm faces a cost increase, one thing it should consider is the cost increase (and its impact on profits if price doesn’t change) versus the costs of changing price (and its impact on profits if price is changed). The magnitude of a cost change on profits relative to the menu costs determines whether or not a given cost change will be passed through.²⁶¹ The larger a cost change or the longer the cost change will last, the more likely the gain to profits from changing price will exceed the costs of changing price, and the more likely the cost change will be passed through.²⁶² Thus, relatively large (significant) and non-transitory cost changes will be passed

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- Bacon, R.W., 1991, Rockets and Feathers: the Asymmetric Speed of Adjustment of UK Retail Gasoline Prices to Cost Changes, *Energy Economics*, Vol. 13.
 - Karp, Larry S. and Jeffrey M. Perloff, 1989, Estimating Market Structure and Tax Incidence: The Japanese Television Market, *Journal of Industrial Economics*; Vol. 37(3), 225-239.

²⁶¹ See, e.g.,

- Pollard, Patricia S. and Cletus C. Coughlin, July 2004, Size Matters: Asymmetric Exchange Rate Pass-Through at the Industry Level, *The Federal Reserve Bank of St. Louis Working Paper Series*, <http://research.stlouisfed.org/wp/2003/2003-029.pdf>.
- Ghosh, Atish and Holger Wolf, 2001, Imperfect Exchange Rate Passthrough: Strategic Pricing and Menu Costs, *CESifo Working Paper*, No. 436, http://www.econstor.eu/bitstream/10419/75783/1/cesifo_wp436.pdf.
- Nakamura, Emi and Dawit Zerom, 2010, Accounting for Incomplete Pass-Through, *The Review of Economics and Statistics*, Vol. 77, No. 3, 1192-1230.
- Gopinath, Gita, and Oleg Itskhoki, May 2010, Frequency of Price Adjustment and Pass-Through, *The Quarterly Journal of Economics*, 125(2) pp. 675 - 727.

²⁶² Costco testified that it passes through cost changes if it has no reason to believe they are temporary: “Q. [...] In a situation where Costco’s costs [...] were significant [...] and in a situation where Costco had no reason to believe that that cost change was temporary, would Costco necessarily increase its retail price on that product? [...] THE WITNESS: Well, if it’s an item that we’re going to continue to purchase at the higher cost, at some point we’re going to have to make an adjustment [...]. Q. BY MR. GRALEWSKI: And when you say make that adjustment,

through, whereas relatively small and short-term cost changes are less likely to be passed through. Therefore, the larger and longer the cost change, the more likely pass-through will occur.

Firms can choose not to pass-through the cost increase in the form of higher prices by earning a lower margin on those sales temporarily until the costs decrease again. However, as I show below in Section VIII.B.2.b), there is a high degree of competition in the production, distribution, and sales of CRT products, which implies that firms earn very low margins on these products; see Exhibits 53 and 54. As such, some firms may be able to temporarily absorb the cost increase, but for significant or permanent cost increases they will be far less able to do so, and will eventually pass-through the cost increase in the form of higher prices.

(3) Pass-through when there are multiple levels of distribution

Pass-through occurs at each stage of the manufacturing and distribution process. As described in Section VI.E, there are several stages in the distribution of CRT monitors and TVs: a CRT manufacturer sells to CRT monitor or TV manufacturer, the manufacturer sells CRT monitors or TVs to a retailer, and the retailer sells the CRT products to the end consumer. When the manufacturer faces an increase in the cost of inputs, it increases its price. Similarly, when the distributor (and its competitors) pays a higher price for the product, it also increases its price; this process continues throughout the entire distribution chain. One can calculate the pass-through rate at any single level of the distribution channel or over multiple levels. The pass-through rate from the top of the distribution channel to the bottom of the distribution channel, or the “channel-length” pass-through rate, is the product of the pass-through rates for each distribution level.

For example, consider an scenario in which Samsung, a CRT manufacturer, sells CRTs to BenQ, a company that makes CRT monitors using those same tubes, for \$100. BenQ then sells the CRT monitors it makes from Samsung’s CRTs to Best Buy, a retailer, for \$115. Best Buy then sells the monitors to end-users for \$120. Now suppose that Samsung increases the price it charges BenQ by 10%, resulting in a tube price of \$110. Suppose that BenQ in turn increases its price to \$130 and that Best Buy in turn increases its price to \$135. The pass-through rate for BenQ is 150%²⁶³ and the pass-through rate for Best Buy is 100%.²⁶⁴ The channel-length rate is 150%, which is the product of the two pass-through rates, $150\% \times 100\% = 150\%$.

One can also measure the impact of the cost increase imposed by Samsung on the price paid by final consumers in a single step. Using the same numerical example above, the channel-length pass-through rate can be calculated directly: the change in price to the end user is \$15 (Best Buy raises its price for the monitor from \$115 to \$130) and the change in cost at the top of the

given the set of factors I indicated in my question, the adjustment would be upwards, correct? [...] A. Yes. Because, in that example, if we kept the – the previous retail price, we would be at a negative margin, which is really against – it’s against our company policy to – to sell things below cost. Yeah.” 07 December 2012, Deposition of Costco Wholesale Corporation 30(b)(6) Witness Geoffrey Shavey (Hereinafter “Costco 30(b)(6) Deposition of Geoffrey Shavey, 07 December 2012”), at 122:15 - 124:5.

²⁶³ Calculated as the change in price (\$130 – \$115) divided by the change in cost (\$110 – \$100).

²⁶⁴ Calculated as the change in price (\$135 – \$120) divided by the change in cost (\$130 – \$115).

channel is \$10 (Samsung raises its price for the CRT from \$100 to \$110);²⁶⁵ therefore, the channel-length pass-through rate is 150%, which is \$15 divided by \$10. Thus, it is not necessary to estimate BenQ's and Best Buy's individual pass-through rates to determine the pass-through rate for a price increase imposed on direct purchasers on to the price that final consumers pay.

The channel-length pass-through rate calculation gives the same result whether it is calculated stage-by-stage or in a single step.

(4) Pass-through is consistent with different price levels

CRTs with the same specifications (or CRT products with the same specifications) may be sold at different prices by different resellers; however, the fact that prices are not the same does not indicate that pass-through differs—or does not occur at all—for these products. While the products may be sold at different prices, they are sold in distribution channels that are highly competitive and, therefore, the pass-through rate will be similar across firms and will be close to 100%.²⁶⁶

In general, although two different firms may be selling a CRT product with the same specifications, from the consumer's perspective they are typically not selling the identical product because firms do more than simply hand over merchandise to purchasers. For example, different retailers provide different levels of customer service, product information, return policies, installation support, pre- and post-purchase consultation, repairs, and store warranties. Different retailers may experience different rental expenses based on the desirability and convenience of their store locations. Some retailers do not advertise at all, while others provide consumers with information pertaining to products available, prices, performance, and store locations. Some retailers operate only online, in which case shipping costs become relevant to the consumer for both the purchase and potential return. The price of the products offered by a retailer in a competitive distribution market reflect all of the costs incurred by the retailer; in turn, the price of the product bundled together with other services, only some of which are described above, will vary among retailers.

The following example illustrates that pass-through is consistent with different prices across retailers. Suppose that retailer A runs a no-frills operation and has cost of \$100 for a CRT monitor plus \$5 per sale in processing costs; intense competition leads retailer A to charge \$105. Retailer B runs a high-status, full-service operation, and has costs of \$100 for the same CRT monitor, \$10 per sale in processing costs, and \$10 per sale in customer service; intense competition leads retailer B to charge \$120. Thus, the same CRT monitor is available for \$105 from retailer A and for \$120 from retailer B. Now suppose that the cost for the CRT monitor increases to both retailers from \$100 to \$110 and other costs are unchanged. Retailer A will raise its price to \$115 and retailer B will raise its price to \$130. The price for the same CRT monitor is higher at retailer B, before and after the increase in the cost of the CRT, and both firms have 100% pass-through.

Prices may also vary across CRTs and CRT products, even at the same distribution firm. For example, graphics quality is superior on high definition TVs compared to standard definition

²⁶⁵ The end consumer price for the CRT monitor increased from \$115 to \$130. Direct purchasers buy tubes which are used to make CRT products; the tube costs increased from \$100 to \$110.

²⁶⁶ I discuss the effects of competition on the pass-through rate in Section VIII.B.1.a).

TVs. Based on the superior graphics, the market price for high definition TVs will be higher than for standard definition TVs that are otherwise identical.²⁶⁷ Regardless of the fact that these products are differentiated and sold at different prices, pass-through still occurs. Further, because these products are sold in highly competitive distribution channels, the pass-through rate is expected to be close to 100%. There is nothing inconsistent between the pass-through of overcharges and product differentiation.

Consider a variation on the earlier numerical example. Suppose that no-frills retailer A sells a standard definition CRT TV model X and a high definition CRT TV model Y. Suppose A pays \$300 for the standard definition CRT TV and \$400 for the high definition CRT TV. Retailer A also bears other processing costs of \$5 for either the standard definition or the high definition CRT TV. Due to intense competition, retailer A sets price to cover its total costs, and prices the standard definition TV model X at \$305 and the high definition TV model Y at \$405. Now suppose that the cost of CRT TV model X increases to \$310 and the cost of CRT TV model Y increases to \$417. Retailer A again sets price to cover its full costs, so prices X at \$315 and Y at \$422. In both cases, retailer A has fully passed on its cost increases. In one case cost increased by \$10, as did price; in the other cost increased by \$17, as did prices.

(5) Pass-through is consistent with loss-leader and other discount pricing

Firms sometimes engage in a variety of pricing techniques to attract customers, including offering discounts (sales) and rebates or using loss-leaders.²⁶⁸ These pricing techniques are simply different forms of marketing expenditure: a reseller incurs a cost in the form of reduced sales revenue in order to entice consumers to purchase its other products. A firm that chooses to incur these marketing expenditures in the actual world would have the same incentive to incur these expenditures in the but-for world in which no price-fixing conspiracy existed. In the but-for world, the only difference would be that the firms' costs were lower absent the alleged overcharge.

The following example illustrates this point. Suppose retailer A has costs of \$300 for a TV, and \$5 in per sale processing costs. Assuming a competitive environment, it will sell the TV for \$305. Suppose retailer A decides to incur a \$10 marketing cost per sale in the form of a sale price, which results in the TV being sold for \$295 (below its cost), with the expectation that A's total profits will increase based on consumers coming in for the low price TV purchasing additional products. Now consider a world in which the cost for the same TV to retailer A is \$260 instead of \$300. Assuming the retailer passes through 100% of its cost change and still incurs the same marketing cost, the resulting price is \$255. In this example, the retailer is still spending \$10 per unit on marketing (it has product and processing costs of \$265, which are discounted by \$10 as a marketing strategy). The retailer is making the same per-unit profit, which is negative \$5 (the expectation is that the reseller will make up this loss on the sale of other more profitable sales, either during the same visit or sometime in the future). In this

²⁶⁷ E.g., the average retail price in the U.S. in April 2006 for a Samsung TX-S2783 27" 4:3 CRT SlimFit TV was \$349 and for a Samsung TX-S2782H 27" 4:3 CRT SlimFit HDTV \$524. Witsview, April 2007, Monthly Major Region Street Price Book, LGE00082765.

²⁶⁸ The term loss-leader refers to an item being sold at a discounted price, sometimes at or even below cost. The purpose of this pricing practice is to attract customers into the store and increase sales on other, more profitable items. Loss-leaders are essentially temporary sales promotions.

example, the retailer has passed-through 100% of the reduced TV price while continuing to use the TV as a loss-leader: the cost to the retailer was reduced by \$40, the same amount by which the price to the consumer was reduced. In this manner, it is evident that incurring marketing costs in the form of discounts or sale prices is unrelated to whether input costs are being passed through, and 100% pass-through of the (savings from the) eliminated overcharge is completely feasible even if the firm is “selling at a loss”.²⁶⁹

(6) Pass-through is consistent with focal point pricing

Focal point pricing is the tendency for firms to set prices at specific price points, which usually end in “9”, such as \$49. The use of this pricing strategy does not prevent the pass-through of overcharges. First, a reseller can pass through cost changes while still using focal point pricing. Second, quality adjustments can be made to offset cost changes, so that the original focal price can be kept. In either event, the overcharge is passed through to the buyer.

Suppose that a firm that uses focal point pricing faces a cost increase. The reseller can simply increase the price to a higher focal point. Suppose a TV OEM sells a CRT TV for \$399, and that the cost of the tube increases from \$60 to \$70. The TV OEM could increase the price of the TV from \$399 to \$409 to compensate for the \$10 cost increase. Alternately, an OEM could adjust the quality of a finished product in order to offset the CRT tube cost increase. Extending the previous example, the TV OEM could switch to a lower quality and less expensive tuner in order to offset the CRT tube cost increase. As such, the OEM maintains the same focal point price; however, the cost increase is still passed-through to the consumer since the consumer pays the same amount for an inferior product. As these examples show, there is nothing inconsistent between focal point pricing and the pass-through of overcharges.

(7) Summary: Pass-through is positive

Deviations from the conditions of a perfectly competitive market prevent firms from the complete and instantaneous adjustment of price to cost changes, but they do not prevent firms from passing through cost changes. None of these deviations individually determines the pass-through rate, and none of these factors are inconsistent with a positive pass-through rate or a pass-through rate of 100%.

In this matter, the cost increases imposed by Defendants were industry-wide,²⁷⁰ they were not transient,²⁷¹ and they were significant.²⁷² Therefore I conclude that the overcharge was passed through to class members.

2. The pass-through rate is close to 100% or more than 100%

- a) The more competitive the industry, the closer the pass-through rate is to 100%

²⁶⁹ This is true for any pass-through rate.

²⁷⁰ See Section VIII.A.2.a).

²⁷¹ The cost increases imposed by the cartel were not temporary. The cartel set prices that were expected to last for quarters, but sometimes months or half-years. See Target price-structure.xlsx in my back-up materials.

²⁷² See Section IX.

Suppose that an industry is imperfectly competitive; the pass-through rate could be above or below 100%. Regardless of whether it was initially above or below 100%, as the degree of competition in the industry increases, the pass-through rate approaches 100%. At the extreme, when the industry achieves perfect competition (and costs are constant), the pass-through rate reaches 100%. The more competitive an industry, the closer the pass-through rate is to 100%.²⁷³

b) The distribution channel is highly competitive and therefore the pass-through rate is likely close to 100%

As described above (see Section VI.E and Exhibit 10), there are multiple steps in the distribution of CRTs to class members. As each of these levels becomes more competitive, the pass-through rate at each level approaches 100% and, accordingly, the channel-length pass-through rate also approaches 100%. The documentary evidence, from a variety of sources, indicates that each of the distribution levels for CRT monitors and TVs is highly competitive.²⁷⁴

There are a large number of firms involved in the production and the distribution of CRT products, which is one indicator of intense competition. There are at least 28 brands of CRT monitors and at least 29 brands of CRT TVs.²⁷⁵ Exhibits 55 and 56 present worldwide market shares for each of the monitor and TV brands.

Intense competition is also evidenced by the lack of concentration among the sellers of CRT products. As explained in Section VI.C.1, HHIs (Herfindahl-Hirschman Indices) are used to measure the degree of concentration. Lower HHI values indicate a less concentrated market and, hence, more competitive conditions for market participants. I calculate HHIs, reported in parentheses, for monitor brands (1121) and TV brands (971);²⁷⁶ these HHIs fall into the “unconcentrated” category based on the DOJ guidelines.²⁷⁷

²⁷³ See, e.g.,

- Benigno, Pierpaolo and Ester Faia, March 2010, Globalization, Pass-Through and Inflation Dynamic, NBER Working Paper 15842, <http://www.nber.org/papers/w15842>, accessed 09 August 2012.
- Verboven, Frank and Theon vanDuk, September 2009, Cartel Damages Claims and the Passing-On Defense, *The Journal of Industrial Economics*, Vol. 57(3), 457-491.
- Werden, Gregory J., Luke M. Froeb, and Steven Tschantz, October 2005, The Effects of Merger Efficiencies on Consumers of Differentiated Products, *European Competition Journal*, Vol. 1(2), 245-264.

²⁷⁴ That the CRT product manufacturing industry is highly competitive is not inconsistent with Plaintiffs’ claims that they paid supra-competitive prices for CRT products. By fixing the price of CRTs, the Defendants in effect are fixing the price of products, because product prices are a function of CRT prices; an increase in the price of CRTs leads to an increase in the price of CRT products, as discussed in Section VIII.B.

²⁷⁵ These numbers are a lower bound because the data contain an “other” category that includes multiple, smaller, brands.

²⁷⁶ Market shares and HHIs are calculated using worldwide quantities sold of TVs for 2005-2006 and monitors for 2004-2006. See,

- DisplaySearch, 2007, Quarterly Desktop Monitor Shipment and Forecast Report, CHU00154421.
- DisplaySearch, 2007, DisplaySearch Q2’07 Quarterly Global TV Shipment and Forecast Report, SEAI-CRT-00223186.

²⁷⁷ According to the 2010 Horizontal Merger Guidelines, the U.S. Department of Justice (DOJ) considers markets with HHIs below 1500 to be “unconcentrated”, between 1500-2500 “moderately concentrated”, and above 2500

Intense competition also leads to low profit rates, which is also a characteristic of the production and distribution of CRT products. The trade press, financial analysts, and industry participants recognized the intense competition and low profit rate; see Exhibit 53.

The trade press reports a high degree of competition in the production, distribution, and sales of CRT products. The firms that produce and distribute CRT products routinely report intense competition. CRT manufacturers also recognize intense competition throughout the entire distribution channel. See Exhibit 54.

c) Pass-through is always greater than 100% when firms use “cost-plus” pricing rules

I explained above that for imperfectly competitive markets, pass-through may be greater than or less than 100%. Under certain conditions, more is known about the magnitude of the pass-through rate. Specifically, if a firm uses cost-plus pricing, its pass-through rate is at least 100%. Cost-plus pricing is the practice of applying a certain markup to cost to set price; the mark-up could be expressed in percentage terms (price is equal to a given percentage above cost) or in dollar terms (price is equal to cost plus a specific dollar mark-up).²⁷⁸

In the case of cost-plus pricing in percentage terms, the pass-through rate is equal to the mark-up rate and is always greater than 100%. For example, suppose that a firm always marks costs up by 20%; if costs are \$100, then the firm sets price at \$120 ($= \$100 \times 120\%$ mark-up). When costs increase by \$1, price will increase by \$1.20 ($= \$1 \times 120\%$ mark-up), and thus the pass-through rate is equal to 120% ($= \text{change in price} / \text{change in cost} = \$1 / \$1.20$). Now consider a firm that uses cost-plus pricing in dollar terms. For example, suppose that a firm always sets price by adding \$40 to its costs. If costs are \$100, the firm sets a price of \$140 ($= \$100 + \40 mark-up). If costs fall to \$99, the firm decreases its price to \$139. In the case of cost-plus pricing in dollar terms, the pass-through rate will always be equal to 100% ($= \text{change in cost} / \text{change in price} = \$1 / \$1$).

d) Firms use “cost-plus” pricing rules

There is evidence that cost-plus pricing policies were used in the distribution channel for CRT products.²⁷⁹ To the extent that resellers follow these pricing policies, a reliable estimate of the pass-through rate is at least 100%.

“highly concentrated”. Department of Justice and Federal Trade Commission, 18 August 2010, 2010 Horizontal Merger Guidelines, at Section 5.3 Market Concentration.

²⁷⁸ For certain types of demand, using a cost-plus rule is the profit-maximizing pricing strategy. This is true if a firm faces a demand curve with constant elasticity of demand (that is, the elasticity of demand is the same at every price). In lay terms, this means that given a 1% increase in price—regardless of whether the starting price is at a high level, a middle level, or a low level—the quantity demanded will decline by the same percentage. Bulow, Jeremy I. and Paul Pfleiderer, February 1983, A Note on the Effect of Cost Changes on Prices, *The Journal of Political Economy*, Vol. 91(1), 182-185, at 183.

²⁷⁹ See, e.g.,

- “Q. Would you sell your product above the FOB price? A. Yes. Q. Always? A. Sure. We needed – we required a markup. So we would buy it FOB, there would be a standard margin that Panasonic, PNA, would have to achieve.” 18 July 2012, Deposition of Panasonic North America 30(b)(6) Witness Edwin Wolff (Hereinafter “Panasonic 30(b)(6) Deposition of Edwin Wolff, 18 July 2012”), at 26:13-27:5.

e) Summary: The pass-through rate is close to 100% or more

Because the resellers of the affected products operated in a highly competitive environment and some resellers utilized cost-plus pricing, I conclude that the pass-through rate is close to 100% or higher. In Section X, I describe the 62 pass-through studies I performed that confirm that pass-through is at least 100%.

3. Market participants recognized that CRT price changes are passed through

The documentary and testimonial evidence in this matter is consistent with the economic theory discussed above. Specifically, Defendants and other market participants explicitly and implicitly acknowledge that distributors, manufacturers, and resellers of CRT products pass-through cost changes to their customers throughout the entire distribution channel.

- Defendants indicate that pass-through of tube prices to product prices occurs. See Exhibit 57.
 - Industry participants, including CRT product makers, market research firms, and the trade press, indicate that pass-through occurs. See Exhibit 58.
-
- Roger De Moor of Philips testified regarding Philips Consumer Electronics margins on sales of CRT monitors to Dell: “Q. Did PCEC typically have a set margin they were trying to achieve when working with Dell? A. We all had. Q. Did that margin vary over time or was there a particular set one within each organization that they aimed for? A. That was on the product level within the organizations.” Philips 30(b)(6) Deposition of Roger De Moor, 31 July 2012, 31 July 2012, at 176:16-177:1.
 - Kimura Mashiro of Panasonic testified regarding CRT product resellers’ profit margins: “Q. So the dealer margin number would always be a positive number? A. Yes, correct.” 19 July 2012, Deposition of Panasonic Corporation, Panasonic North America and MTPD 30(b)(6) Witness Mishiro Kimura (Hereinafter “Panasonic 30(b)(6) Deposition of Mishiro Kimura, 19 July 2012”), at 69:22-24.
 - Roger De Moor of Philips testified: “Q. So on bigger retailers, was there a particular margin that each different retailer always or often tried to achieve? MR. EMANUELSON: Objection, vague. A. That’s my understanding.” Philips 30(b)(6) Deposition of Roger De Moor, 31 July 2012, at 302:3-7.
 - Thomas Heiser of Hitachi USA testified regarding retailers’ margins: “Again, you know, at the time in ’96 it was our understanding that Circuit City and those guys, they typically were between 30 and 40 percent, 30 and 40 points max – margin, I mean, so... Q. Okay. And what do you mean by retail margins, just to make sure we’re on the same page? A. So if they bought a set for 700 from Hitachi, they’d sell it for 999. They would mark it up 30 percent or 40 percent was their markup. Q. And that was your understanding of approximately for the large retailers? A. Yeah, at that time.” Hitachi 30(b)(6) Deposition of Thomas Heiser, 03 July 2012, at 151:17-152:3.
 - “That markup of nearly 50% of the total cost is a ‘healthy profit margin’ for Amazon, said Van Baker, a Gartner Inc. analyst, adding that most consumer products have markups of 20% to 25% of total cost. ‘A markup of 50% of total cost is almost impossible to do in consumer electronics just because the market is so competitive’.” Matt Hamblen, 22 April 2009, Material costs for Kindle 2 are about half its retail price, ComputerWorld, http://www.computerworld.com/s/article/9131974/Materials_costs_for_Kindle_2_are_about_half_its_retail_price_, accessed 14 September 2012, at 1.
 - Prices between DDI, a subsidiary of MTPD, and Funai were set using cost-plus rules: “Funai was a joint venture. So they were able to look at all the costs: The costs for the materials, for the labor, all costs. So all of the cost information was openly shared, and so it was cost plus a set margin.” Panasonic 30(b)(6) Deposition of Tatsuo Tobinaga, 16 July 2012, at 139: 13-17.

- The tie between CRT prices and CRT product prices is also reflected by CRT makers following CRT product “street prices”, which are the prices for CRT products paid by end-users; following street prices reveals that the Defendants recognize the tie between tubes and product prices. See Exhibit 59.
- Market research firms, which provide data that Defendants rely upon,²⁸⁰ regularly publish street prices. See Exhibit 60.

Trial testimony in a case involving price fixing of LCD panels by many of the same Defendants and Best Buy indicated that pass-through occurs. See Exhibit 61.

All in all, there is ample documentary and testimonial evidence, from a variety of market participants, showing that CRT product prices ultimately reflect increases in CRT prices.

4. Summary: Class members were harmed by the cartel

Based on economic theory and documentary and testimonial evidence, I conclude that the price increase to direct purchasers was passed through. This conclusion is further supported by the 62 statistical pass-through studies I conducted, as described in Section X and summarized in Exhibits 62 and 63. Furthermore, I am aware of no empirical study that contradicts the

²⁸⁰ See, e.g.,

- Samsung testified: “Q. You mentioned earlier, I think you said the Marketing Department utilizes and sometimes relies on DisplaySearch information; is that accurate? A. That’s accurate.” 16 July 2012, Deposition of Samsung Electronics America 30(b)(6) Witness Kim London (Hereinafter “Samsung 30(b)(6) Deposition of Kim London, 16 July 2012”), at 262:16-19.
- Philips testified about responsibilities of another Philips employee: “Q. Do you know what his responsibilities were? A. Collect information about market trends, working with DisplaySearch, and presenting to management the information on which they could base their plans.” Philips 30(b)(6) Deposition of Roger De Moor, 31 July 2012, at 70:19 - 71:1.
- LG Electronics testified: “Q. Okay. Who were the two third-party sources for market share information that you mentioned? A. One is a company called NPD. The other is a company called Display Search.” 11 July 2012, Deposition of LG Electronics 30(b)(6) Witness Yun Seok Lee (Hereinafter “LGE 30(b)(6) Deposition Yun Seok Lee, 11 July 2012), at 78:8-11.
- Hitachi America testified: “Q. Do you know whether HAL used data sources such as Display Search? A. Yes.” 23 August 2012, Deposition of Hitachi America, LTD. 30(b)(6) Witness William Allen Whalen (Hereinafter “Hitachi 30(b)(6) Deposition of William Allen Whalen, 23 August 2012”), at 110:24 - 111:1.
- Chunghwa testified: “Q. Do they -- to your knowledge did Chunghwa buy information from DisplaySearch in the course of running its business? A. DisplaySearch is a very fair and objective market surveyed agency. Everybody would subscribe to it, not only Chunghwa Picture Tubes.” Deposition of Chih Chun-Liu, Vol II, 20 February 2013, at 324:19 - 324:25.
- Panasonic testified: “Q. [...] Did you monitor the finished product prices of CRT TVs [...] during the 2004 to 2008 time frame. A. Yes. [...] Q. BY MR. LAMBRINOS: What documents did you use to track these prices? Please answer the question. A. Since market research, the companies that publish the price trends and so forth, I used such information to track down prices.” Panasonic 30(b)(6) Deposition of Hirokazu Nishiyama, Vol. I, 17 July 2012, at 39:18 - 40:9.
- Toshiba testified: “Q. And how would you go out and monitor television pricing? A. Actually there was a couple different ways you can do it. There’s reports you can go buy. I think there was like Stanford, Stanford Research or Display Search ...” TAEC 30(b)(6) Deposition of Jay Alan Heinecke, 31 July 2012, at 119:19 - 120:2.

theoretical findings. That is, I am aware of no study published in a peer-reviewed journal that has found a pass-through rate of zero. Thus, all class members suffered common damage in the form of higher prices.

IX. 25.0% and 9.5% are reasonable measures of the direct overcharge imposed on CDTs and CPTs, respectively

In Section VIII I presented the evidence and analyses on which I formed my opinion that Defendants' and Co-conspirators' conduct resulted in class members paying more for CRT products than they would have absent the cartel. In this section I apply widely-accepted economic principles and methods in a manner consistent with practices in the field of economics to the evidence of the case to quantify the amount by which Defendants overcharged the Class for CRT products by cartelizing CRTs.

Plaintiffs are indirect purchasers. Consequently, overcharges imposed on the class can be decomposed into (1) a measure of overcharge harm imposed on direct purchasers of CRTs integrated into products purchased by members of the class ("at-issue CRTs") and (2) the portion of that direct overcharge passed through to class members. I now describe the reasoning and evidence that support my conclusion that the cartel imposed a 25.0% overcharge for CDTs and a 9.5% overcharge for CPTs.²⁸¹ I detail my pass-through analysis in Section X and provide measures of total damages in Section XI.

The overcharge damages are the difference between the dollar amount that direct purchasers spent on at-issue CRTs in the actual world in which Defendants engaged in the collusive conduct and the dollar amount they would have spent if the Defendants had not engaged in the anticompetitive conduct. Formulaically, the dollar value of overcharge damages imposed on direct purchasers by Defendants is measured as:

$$\text{\$Expenditures with Cartel} - \text{\$Expenditures without Cartel}.$$

Because the but-for world is by definition hypothetical, expenditures that direct purchasers would have made absent the cartel are not observable. Consequently, the overcharge cannot be directly observed.²⁸² Economists have developed a number of research methods to use observable information to estimate outcomes in the unobservable but-for world.²⁸³ I apply one of

²⁸¹ As explained in Section IX.B, I estimate two overcharges for CDTs and for CPTs, one for the time period 1995Q2 through 2006Q4 and another for 2007.

²⁸² "One of the central challenges of an overcharge analysis is determining the counterfactual scenario that would have existed but for the alleged anticompetitive conduct. While actual prices generally are known, the but-for prices are not observable and thus must be estimated." American Bar Association, 2010, *Proving Antitrust Damages: Legal and Economic Issues*, Second Edition, ABA Publishing: Chicago, p. 198.

²⁸³ See, e.g.,

- "Many empirical questions in economics and other social sciences depend on causal effects of programs or policies. In the last two decades, much research has been done on the econometric and statistical analysis of the effects of such programs or treatments...The object of interest is a comparison of the two outcomes for the same unit when exposed, and when not exposed, to the treatment. The problem is that we can at most observe one of these outcomes because the unit can be exposed to only one level of the treatment. Holland (1986) refers to this as the 'fundamental problem of causal inference.' In order to evaluate the effect of the treatment we therefore always need to compare distinct units receiving the different levels of the treatment. Such a comparison can involve different physical units, or the same physical unit at different time."

the most widely used of these methods, regression analysis, to the facts and data of the case to obtain a reasonable measure of the effect of the cartel on CRT expenditures.

A. I use widely-accepted economic principles and methods to quantify the direct overcharge

In the absence of observations of the CRT prices in the but-for world, one reasonable way to estimate the direct overcharge is to compare CRT prices in periods from the actual world in which no collusive behavior occurred to CRT prices during periods of collusion. CRT prices from different time periods may reflect changes in more than just whether firms compete or collude. For instance, if a significant input in the production of CRTs had a higher price in the time period when the cartel operated relative to its price in the time period when the cartel did not operate, the price of CRTs would be expected to be higher during the cartel in part because of the cost increase and not solely because of the difference in competitive and collusive conduct. Since CRT prices can be affected by more than the decision by suppliers to collude or compete, an estimate of the impact of the cartel must control for changes in CRT prices due to changes in other relevant factors.

Economists often use regression analysis to isolate the impact of one variable on another from the impact of other variables,²⁸⁴ and the courts commonly accept regression analysis.²⁸⁵ I use

Imbens, Guido W. and Jeffrey M. Wooldridge, 2009, Recent Developments in the Econometrics of Program Evaluation, *Journal of Economic Literature*, Vol. 47, No. 1, 5-86, at 5.

- “The problem of evaluating the effect of a binary treatment or program is a well studied problem with a long history in both econometrics and statistics. This is true both in the theoretical literature as well as in the more applied literature.” Imbens, Guido W. and Jeffrey M. Wooldridge, 2009, Recent Developments in the Econometrics of Program Evaluation, *Journal of Economic Literature*, Vol. 47, No. 1, 5-86, at 5.

In the present case, cartelization is the “treatment” and the difference in price between the without- and with-cartel periods is the “effect.” The “fundamental problem of causal inference” is that the but-for price never existed due to the cartel and therefore is not observable.

²⁸⁴ See, e.g.,

- “One of the more useful aspects of the multiple regression model is its ability to identify the independent effects of a set of variables on a dependent variable.” Greene, William H., 2012, *Econometric Analysis*, Seventh Edition, Prentice Hall: Upper Saddle River, at 14.
- “Regression models form the core of the discipline of econometrics.” Davidson, Russell and James G. MacKinnon, 2004, *Econometric Theory and Methods*, Oxford University Press: New York, at 1.
- “[T]he classical linear regression model...is the workhorse of econometrics.” Gujarati, Damodar, 2011, *Econometrics by Example*, Palgrave Macmillan: New York, at xvi.

²⁸⁵ See, e.g.,

- Rubinfeld, Daniel L., 2000, Reference Guide on Multiple Regression, in Federal Judicial Center, and National Research Council (Eds.), *Reference Manual on Scientific Evidence*, Third Edition, National Academies Press: Washington, D.C., 303-358.
- “Econometric and regression analyses are particularly useful in separating the impact of an alleged anticompetitive act on market outcomes (such as pricing) from the influence of other factors.” American Bar Association, 2010, *Proving Antitrust Damages: Legal and Economic Issues*, Second Edition, ABA Publishing: Chicago, at 125.
- “Multiple regression and other econometric methods have been used frequently in cases brought by the competition authorities and in private litigation.” Rubinfeld, Daniel L., 2008, *Quantitative Methods*, in

regression analysis to isolate the impact of the cartel on CRT prices from the impact of other factors that may have also contributed to any CRT price differences between the with- and without-cartel periods.

As a first step in the regression analysis, an understanding of which variables may affect CRT prices is developed. Widely-accepted economic theory holds that a combination of supply factors, demand factors, and competitive interactions between suppliers drive market prices.²⁸⁶ Consequently, by using data on CRT prices, supply and demand factors, and the nature of competitive interactions between CRT producers, I can implement regression analysis to the case facts and data to analyze the impact of collusion on CRT prices separately from the changes in CRT prices due to changes in non-cartel related supply and demand factors.

1. Reduced-form price equations are widely used and accepted

A type of model of the price-formation process widely used in empirical economics is what is known as a reduced-form price equation model – “reduced-form” because the system of supply and demand factors that co-determine price can be reduced mathematically to a single equation that relates prices to supply factors, consumer demand, and the competitiveness of the market.²⁸⁷ When measuring the price-effect of changing from an economic environment in which firms do not collude to one in which firms do collude, a cartel indicator variable that identifies whether

Antitrust, in American Bar Association (Eds.), Competition Law and Policy, Section of Antitrust Law, Issue 1, ABA Publishing: Chicago, 723-742, at 723.

- “The legal requirements for regression analysis fall under the rules for testimony by experts...Regression analyses have met these requirements many times in litigation for a wide range of issues, including the estimation of antitrust damages.” American Bar Association, 2010, Proving Antitrust Damages: Legal and Economic Issues, Second Edition, ABA Publishing: Chicago, at 128-129.

²⁸⁶ See, e.g.,

- Firm strategy “requires an understanding of how the price or quantity equilibrium depends on cost and demand functions.” Church, Jeffrey, and Roger Ware, 2000, Industrial Organization: A Strategic Approach, McGraw-Hill: New York, at 233.
- “Market outcomes are determined by three factors: the nature of demand, the nature of the production process, and the nature of competitive interaction among suppliers.” Porter, Robert and J. Douglas Zona, 1994, Bidding, Big Rigging, and School Milk Prices: Ohio v. Trauth, in Kwoka, Jr., John E. and White, Lawrence J. (Eds.), 2004 The Antitrust Revolution: Economics, Competition, and Policy, Fourth Edition, Oxford University Press: New York, at 213.

²⁸⁷ See, e.g.,

- “The most common statistical method employed in antitrust litigation involves the estimation of ‘reduced-form’ price equations. A typical reduced-form model might explain the variation in the price of a product as a function of a series of variables relating to cost, demand, and market structure.” Rubinfeld, Daniel L., 2008, Quantitative Methods, in Antitrust, in American Bar Association (Eds.), Competition Law and Policy, Section of Antitrust Law, Issue 1, ABA Publishing: Chicago, 723-742, at 724.
- “A ‘reduced form’ model is a single equation that describes prices (the dependent variable) as a function of various exogenous factors thought to influence supply and demand (such as costs, prices of substitutes, etc.).” American Bar Association, 2010, Proving Antitrust Damages: Legal and Economic Issues, Second Edition, ABA Publishing: Chicago, at 201.
- McCrary, Justin, and Daniel L. Rubinfeld, 2014, Measuring Benchmark Damages in Antitrust Litigation, Journal of Econometric Methods, 3(1), 63-74.

the observed data are from a cartel or non-cartel period is also included in the model to isolate the effect of the cartel on prices from price changes due to other factors.²⁸⁸

The cartel-indicator reduced-form price equation approach provides a widely-accepted economic framework by which to identify the changes in CRT prices due to the presence of the cartel separately from changes in CRT prices due to non-cartel factors.

B. The facts and data of the case form the basis for the direct overcharge measure

Although generally-accepted economic principles and methods provide the analytic framework, Defendants' sales data combined with relevant CRT supply and demand data form the evidentiary basis for the direct overcharge measure.

As explained in Section IX, due to the unavailability of prices class members would have paid in a world absent cartelization, I analyze Defendants' CRT sales data from time periods not believed cartelized and time periods with evidence of collusion.

I select my cartel date based on relevant evidence from the case. In particular, as I discuss in Section VIII.A.3.a) case evidence indicates that information exchanges began as early as February 1995 and continued through at least late 2007.²⁸⁹ Additionally, I take into account the fact that the Department of Justice (DOJ), Korean Fair Trade Commission, and Japanese Fair Trade Commission cartelization investigation into a number of LCD producers, including some defendants in this case, became public in the last quarter of 2006.²⁹⁰ It is possible that members of the CRT cartel changed their behavior in response to learning of these investigations in an attempt to minimize costs in the event of an investigation in the CRT industry. For example, cartel members may have considered becoming amnesty applicants in the CRT cartel or may have been less likely to continue meeting. If the LCD investigation did influence the behavior of

²⁸⁸ The cartel-period indicator model is one variant of the general "economic determinants" method of quantifying cartel effects I described in my class certification report. Netz Class Cert Report, at 85.

²⁸⁹ Documented instances of information exchanges in 2007 regarding CDTs include:

- Oh, Tae Gyun, 10 November 2007, E-mail, Subject: Record of visits to Company C, SDCRT-0139342.
- Choi, Hoon, 14 September 2007, E-mail, Subject: A report on the glass supply condition of Chunghwa, SDCRT-0104771 - SDCRT-0104772.

Documented instances of information exchanges in 2007 regarding CPTs include:

- Lee, Dae-Eui, 19 September 2007, Request for Survey on Customer Response to Price Increase, SDCRT-0080694 - SDCRT-0080696.
- Choi, Kee, 13 July 2007, E-mail, Subject: Information Sharing] Main contents at the LPD meeting - 7/12 (Thu), SDCRT-0170843.
- Sanogaway, Masaki, 09 November 2007, E-mail, Subject: Meeting memo, MTPD-0543148 - MTPD-0543150.

²⁹⁰ See, e.g.,

- 12 February 2014, Brief for the United States of America, United States of America v. Shiu Lung Leung (In the United States Court of Appeals for the Ninth Circuit).
- Gohring, Nancy, 11 December 2006, LG.Philips Subpoenaed in LCD Competition Probe, InfoWorld, <http://www.infoworld.com/d/security-central/lgphilips-subpoenaed-in-lcd-competition-probe-354>, accessed 08 April 2014.

CRT cartel members, I expect the impact of the cartel to be smaller subsequent to the announcement of the LCD cartel investigation; however, I do not impose such a restriction on the model. I bifurcate the cartel period (1995Q2-2007Q4) into two segments based on the LCD investigation becoming public. Specifically, the first segment includes 1995Q2 - 2006Q4 and the second includes 2007Q1-2007Q4.

The most complete set of data for this analysis would include expenditures by direct purchasers on all at-issue CRTs – sold during the cartel period – and the expenditures by direct purchasers for CRTs that had the same (economically relevant) product characteristics from periods free from cartelization. Since expenditures are the product of the price of a good and the number of units purchased, expenditures on Defendants' CRTs can be calculated from Defendants' sales data, which reveal transaction quantities and revenues.

Net prices and other sales data for Defendants' CRTs from January 1, 1991 forward were requested.²⁹¹ Data produced in response to these requests have been incomplete, with some Defendants failing to provide any data whatsoever.²⁹² Data that were produced vary by Defendant in terms of time periods covered and production facilities included.²⁹³ See Exhibit 64 for a list of Defendant data files used in my analyses.

Because the produced sales data may contain rebates, returns, or corrections to erroneous entries, I aggregate the transaction-level sales data to the quarterly level.²⁹⁴ Additionally, as described below, I incorporated data from third parties to control for changes in CRT prices due to non-cartel factors, and these data are reported at the quarterly level. Therefore, aggregating the price

²⁹¹ See, e.g.,

- 10 June 2008, Indirect Purchaser Plaintiffs' First Request for Production of Documents from Defendants, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).
- 25 March 2010, Indirect Purchaser Plaintiffs' Second Request for Production of Documents from Defendants, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).
- 04 June 2008, Direct Purchaser Plaintiffs' First Set of Requests for Production of Documents, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).
- 12 March 2010, Direct Purchaser Plaintiffs' Second Set of Requests for Production of Documents, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).

²⁹² Defendants Thomson/Videocon, Orion/Daewoo, IRICO, Samtel, and Thai-CRT did not produce CRT tubes sales data.

²⁹³ For example, LPD only provided data from its Ottawa, Ohio plant.

²⁹⁴ For example, on May 21, 1996 Philips recorded three invoices for customer order 300722, each with 416 units priced at \$189.49. On June 11, 1996, Philips recorded three invoices containing the note "300722 WRONG PRICE" that reversed the May 21 sales. Another three invoices from June 11, 1996 re-invoice the original sales at a price of \$187.46. When collapsing by quarter, these observations show up as a single observation with the corrected price of \$187.46.

This method of aggregating does not completely resolve the problem of adjustments in the data, as an adjustment may occur during a different quarter than the original transaction, but it does mitigate the problem.

data to the quarterly level allows all variables in the price equation to be measured at the same time frequency.

Subsequent to filtering and cleaning, the produced CRT sales data deemed usable for the overcharge analysis include quarterly price observations beginning in 1993Q1 and continuing through 2010Q4.

- There are 49 CDT price observations from Chunghwa, LGE, Panasonic, Philips, and Toshiba prior to 1995Q2; for CPTs there are 145 observations from Chunghwa, Hitachi, LGE, Panasonic, Philips, and Toshiba.
- Between 1995Q2 and 2006Q4 there are 1,011 CDT price observations from Chunghwa, Daewoo, Hitachi, LGE, LPD, Mitsubishi, Panasonic, Philips, Samsung, and Toshiba; for CPTs there are 2,155 observations from the same manufacturers plus Irico, Samtel, and Thai CRT.
- In 2007, there are 38 CDT price observations from Chunghwa, LPD, and Samsung; for CPTs there are 168 observations in 2007 from Chunghwa, Daewoo, Irico, LPD, Panasonic, Samsung, and Samtel.
- There are 16 CDT price observations from Chunghwa and LPD after 2007; for CPTs there are 106 observations from Chunghwa, Daewoo, Irico, LPD, and Samtel.

Although, as is generally the case in empirical research, the set of data available for the analysis does not cover the entire population of interest, I consider the available data sufficiently complete to provide a reasonable measure of the cartel overcharges.²⁹⁵ I base my opinion on the comprehensive sales data requests made of the Defendants, the lack of evidence that Defendants systematically withheld data, the availability of useable data from before and after the cartel period, and the ability of the dummy variable approach to provide reliable estimates in situations with relatively limited data.²⁹⁶

²⁹⁵ See, e.g.,

- “Multiple regression uses a sample, or a selection of data, from the population (all the units of interest) to obtain estimates of the values of the parameters of the model.” Rubinfeld, Daniel L., 2011, Reference Guide on Multiple Regression, Reference Manual on Scientific Evidence, Third Edition, National Academies Press: Washington, D.C., 303-357, at 312.
- “Samples presented in the courtroom have ranged from 5 (tiny) to 1.7 million (huge).” Kaye, David H. and David A. Freeman, 2011, Reference Guide on Statistics, Reference Manual on Scientific Evidence, Third Edition, National Academies Press: Washington, D.C., 211-302, at 247.

²⁹⁶ Making judgments about the usefulness of a particular set of data is part of the job of a researcher. Moreover, one strength of the dummy variable approach is its usefulness when data is relatively limited. See, e.g.,

- “The validity of data is ultimately a matter of judgment.” Allen Mark A., Hall, Robert E, et al., 2011, Reference Guide on Estimation of Economic Damages, Reference Manual on Scientific Evidence, Third Edition, National Academies Press: Washington, D.C., 425-502.
- “The dummy variable approach is appealing because it can be applied even where there is a relative paucity of data in the nonconspiratorial period.” Rubinfeld, Daniel L., 2008, Quantitative Methods in Antitrust, Competition Law and Policy, Issue 1, ABA Section of Antitrust Law, 723-742, at 740.

In addition to Defendants sales data, I collected data related to CRT manufacturing costs, the availability of potential substitutes, and indicators of world-wide demand to control for the influence of CRT supply and demand factors on CRT prices.

Manufacturing costs are a key supply factor relevant to a product's price. Cost data beginning January 1991 have been requested from Defendants.²⁹⁷ However, insufficient defendant-specific cost data that could be directly included in the regression analysis have been produced at this point. In particular, defendant cost data either do not cover the required time period, aggregate over multiple cost categories without indicating how to disaggregate, or simply have not been produced.²⁹⁸

A number of organizations collect and publish cost data that are relevant in the present case. Economists often use such information in research. The costs of the glass funnels and panels comprise a significant portion of the materials cost.²⁹⁹ I included CPT glass price data from the

²⁹⁷ See, e.g.,

- 25 March 2010, Indirect Purchaser Plaintiffs' Second Request for Production of Documents from Defendants, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).
- 12 March 2010, Direct Purchaser Plaintiffs' Second Set of Requests for Production of Documents, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).

²⁹⁸ See, e.g.,

- "The LGE defendants do not have transactional cost data in a centralized, electronic database." Shapland, Eric, 30 March 2012, Letter from Eric Shapland to R. Alexander Saveri and Lauren C. Russell, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).
- "We replied on October 31, 2011 that the Panasonic Defendants had been unable to identify cost data pertaining to CRTs or CRT finished products in a consolidated, readily accessible format." Hemlock, Adam C., 04 May 2012, Letter from Adam C Hemlock to Michael Christian, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).
- "...data regarding costs and transactions prior to 1998 is not available." Scarborough, Michael, 08 March 2012, Letter from Michael Scarborough to R. Alexander Saveri and Lauren C. Russell, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).

²⁹⁹ See, e.g.,

- "A. Of the total cost, the material cost was around 70 percent, and of that 70 percent was for glass, the cost for Panel and funnels. So I think I can say that approximately half the cost was for glass." Panasonic 30(b)(6) Deposition of Tatsuo Tobinaga, 16 July 2012, at 84:5 - 8.
- "CRT glass typically accounts for about 40% of the overall production cost of CPT and about 22% of that of CDT." ABN AMRO Bank, N.V., Citibank/Salomon Smith Barney Hong Kong Limited, et al., May 2001, LG.Philips Displays Holding B.V. US\$2,000,000,000 Senior Term Loan and Revolving Credit Facility, PHLP-CRT-051982 - PHLP-CRT-052085, at 2035.
- "With a trend toward larger picture tubes, glass represents a growing percentage of the value of materials, currently around 60 percent, up from 30 percent just a few years ago." United States International Trade Commission, May 1995, Industry & Trade Summary: Television Picture Tubes and Other Cathode-Ray Tubes, USITC Publication 2877, p. 4, http://www.usitc.gov/publications/701_731/pub3695.pdf, accessed 17 May 2012.

Bank of Korea in the regression analysis to account for variation in CRT prices due to changes in production costs.³⁰⁰

Changes in demand conditions may also result in changes in product prices. In particular, income and the availability of functional substitutes are key drivers of consumer demand. Because CRT products are sold worldwide, I included data on gross domestic product and unemployment from the Organisation for Economic Co-operation and Development (OECD), a source commonly used by economists and that includes more countries than other similar data sets, to account for changes in CRT prices due to changes in demand conditions flowing from changes in income.^{301, 302}

The availability of functional substitutes also influences the level of consumer demand for a product. In the present case, other display technologies such as LCD monitors and TVs provided functional substitutes for end-users. Data on worldwide LCD TV and monitor revenues as a share of total TV and monitor revenues are included in the regression to account for changes in the level of demand for CRTs.³⁰³

To account for the effect of additional factors that influenced the trend in CRT prices over the long term, I included a second order time trend. This trend is composed of a linear and a quadratic component. The linear component takes a value of one in 1993q1 and increases by one in each subsequent quarter. The quadratic component equals the square of the linear component. In addition to capturing the overall trend in CRT prices, these variables address the “spurious regression problem” that can occur with data that vary over time. If both the dependent variable and an independent variable are growing over time, then a regression might find a statistical relationship between the two even if a different economic relationship exists. Adding a time trend to the model eliminates this problem³⁰⁴ and allows for a more accurate estimate of the overcharge.

Formulaically, I estimated the following reduced-form price equation to quantify the CRT cartel effect:

³⁰⁰ The Bank of Korea, Undated, Producer Price Indexes Bank of Korea, http://ecos.bok.or.kr/flex/EasySearch_e.jsp, accessed 10 October 2013.

³⁰¹ The current members of the OECD are Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States. Organisation for Economic Co-operation and Development, 17 February 2014, Members and Partners - OECD, <http://www.oecd.org/about/membersandpartners/>, accessed 17 February 2014.

³⁰² I also considered using a measure of global output produced by the World Bank to account for changes in demand in countries that are not members of the OECD, including China and India. However, these data only extend through the beginning of 1994.

³⁰³ Although LCD TVs and monitors provided similar functionality as CRT TVs and monitors, they do not appear to have been economic substitutes, in the sense of CRT manufacturers being able to attract LCD customers by altering CRT prices, for much of the time period of interest in the present case. For more details see the discussion in Section VIII.A.2.c).

³⁰⁴ “The phenomenon of finding a relationship between two or more trending variables simply because each is growing over time is an example of a spurious regression problem. Fortunately, adding a time trend eliminates this problem.” Wooldridge, Jeffrey M., 2000, *Introductory Econometrics: A Modern Approach*, South-Western College Publishing: Mason, at 334 - 335.

$$\begin{aligned} \ln \text{Price}_{it} = & \alpha + \theta_1 \text{Cartel1995-2006}_t + \theta_2 \text{Cartel2007}_t \\ & + \beta_1 \ln \text{Glass}_t + \beta_2 (\ln \text{Glass}_t \times \text{Size}_{it}) + \beta_3 (\ln \text{Glass}_t \times \text{Size}_{it}^2) \\ & + \beta_4 \ln \text{GDP}_t + \beta_5 U_t + \beta_6 U_t^2 + \beta_7 \ln \text{LCD}_t + \beta_8 \ln \text{LCD}_t^2 \\ & + \gamma_1 \text{Time}_t + \gamma_2 \text{Time}_t^2 + \delta \text{Quarter}_t + \eta \text{Maker}_{it} + \rho (\text{Maker}_{it} \times \text{Size}_{it}) + \varepsilon_{it} \end{aligned}$$

where:

- Price_{it} measures the price charged for CRT model-manufacturer pair i at time t ;
- the indicator variable Cartel1995-2006_t equals one from 1995Q2 until 2006Q4 and zero otherwise; Cartel2007_t equals one from 2007Q1 until 2007Q4 and zero otherwise;
- Glass_t measures the price of CRT glass at time t ; $\ln \text{Glass}_t \times \text{Size}_{it}$ allows for the possibility that changes in glass prices affect CRT prices differently for different sized CRTs and $(\ln \text{Glass}_t \times \text{Size}_{it}^2)$ allows for a non-linear impact of a change in glass prices on CRT prices;
- GDP_t and U_t are the OECD output and unemployment rate at time t and the inclusion of U_t^2 allows for changes in unemployment to affect CRT prices differently at different levels of unemployment;
- LCD_t measures the revenue from the sale of LCD finished TVs or monitors as a share of total revenues from the sale of finished TVs or monitors and the inclusion of LCD_t^2 allows for changes in revenue share of LCDs to affect CRT prices differently depending on how prevalent LCDs are in the market;
- Time_t and Time_t^2 are the time variables allowing for a trending influence on price; the Quarter_t variables equal one in the relevant calendar quarter of the year and allow for the possibility of seasonal trends in CRT prices;
- the indicator variable Maker_{it} identifies the manufacturer for the model-manufacturer pair i at time t and $\text{Maker}_{it} \times \text{Size}_{it}$ allows for the possibility that price differences between CRTs may vary based on the maker and size.³⁰⁵

Some case evidence suggests that prices of CDTs and CPTs did not respond to changes in market conditions in the same manner;³⁰⁶ therefore, I estimated separate CDT and CPT regressions. I

³⁰⁵ The coefficients on the supply and demand variables in a reduced-form price equation are not necessarily directly interpretable as they combine effects from both the supply side and demand side of the market into a single coefficient. See, e.g.,

- “When interpreting reduced-form regression coefficients...one needs to remember that these parameters are a function of those from the underlying structural model...Therefore, while the expected sign of a reduced-form regression is informed by economic theory, it also is dependent on the underlying structural regression coefficients (some of which may have opposing effects on equilibrium price).” Nieberding, James F., November 2006, Estimating Overcharges in Antitrust Cases Using a Reduced-Form Approach: Methods and Issues, *Journal of Applied Economics*, Vol. 9(2), 361-380, at 365-366.
- A reduced-form price equation “is not typically interpreted as an inverse demand equation, but rather a reduced form model for price. Consequently, there may be no economic basis for the assumption that the quantity and unexplained price deviations are negatively related.” McCrary, Justin, and Daniel L. Rubinfeld, 2014, Measuring Benchmark Damages in Antitrust Litigation, *Journal of Econometric Methods*, 3(1), 63-74, at 66.

also limited the CDT after-cartel period to an end-date of 2008Q4 since there is evidence that by the end of 2008 Chunghwa was the primary CDT manufacturer.^{307,308}

The regressions result in estimates of overcharges to direct buyers of CDTs of 25.0% prior to the LCD cartel investigation becoming public and 12.3% after and an overcharge of 9.5% to direct purchasers of CPTs prior to the LCD cartel investigation becoming public and 3.2% after.

These overcharge rates are consistent with economic theory applied to the case evidence that Defendants organized and participated in a long-standing cartel despite the substantial costs and risks of doing so.³⁰⁹ As expected, the pre-LCD investigation overcharges are higher than the post-investigation overcharges, and the two are statistically significantly different.³¹⁰ Moreover, these results are within the typical cartel overcharges range estimated in scholarly empirical research on the topic.³¹¹

In addition to fitting with economic theory and being consistent with other studies of cartel overcharges, my model provides a good statistical fit to the data and the results are statistically significant. See Exhibit 65 for the regression results.

As additional sensitivity checks I consider what happens when:

³⁰⁶ See, e.g., “And glass bulb price was increased from 2Q. 2. So, we believe that price can be increased from 3Q. 3. But, TV & DSP [display or monitor] market are quite different, the action must be taken very carefully. So we would like to suggest Guideline of price and timing expected be decided on the meeting of Apr. 15. Finally, CPT maker need to have a meeting to discuss detailed action plan to increase the price from 3Q in the beginning of May.” Chunghwa Picture Tubes, LTD, 09 April 1999, Visitation Report, Subject: 14", 20", 21" CPT Respective Makers' Recent Status and Price Opinion Review, CHU00028606 - CHU00028608, at 8608.01E.

³⁰⁷ Although Samsung's produced CDT sales data ends after 2007Q4 and LPD's after 2008Q2, there is evidence that both companies continued selling CDTs through late 2008. See, e.g.,

- Samsung 30(b)(6) deposition testimony that the company produced and sold CDTs through 2008. Samsung SDI 30(b)(6) Deposition of Jaemin Lee, Vol. II, 07 June 2012, p. 176.
- Actual sales through September 2008 are reported in A.A.M. Deterink, 20 November 2008, Trustee's Sixth Report in the bankruptcy of LG.Philips Displays Holding B.V. and LG.Philips Displays Netherlands B.V. and LG.Philips Displays Investment B.V., p. 11, <http://deterinklive.com/nl/publicaties/faillissementsverslagen/l/>, accessed 12 July 2012.

³⁰⁸ As I discuss below, my overcharge estimate is robust to extending the CDT after-cartel period to 2010Q4, the same period I use for CPTs.

³⁰⁹ “[T]he underlying economic theory provides a vital check” of a regression model. Pindyck, Robert S. and Daniel L. Rubinfeld, 2005, *Microeconomics: Sixth Edition*, Prentice Hall: Upper Saddle River, at 679.

In the present case, economic theory predicts that “Only if a cartel is expected to raise the price above the noncartel price and keep it high do firms join. [Accompanying footnote:] If the noncartel price is close to the cartel price, then firms may not believe that joining the cartel is profitable given the legal liability they potentially face from belonging to the cartel.” Carlton, Dennis W. and Jeffrey M. Perloff, 2005, *Modern Industrial Organization*, Fourth Edition, Person Addison Wesley, at 131.

³¹⁰ I used an F-test to test the hypothesis that the coefficients for the first and second direct overcharge coefficients were equal. For both CPTs and CDTs, this hypothesis was rejected with a p-value of 0.00.

³¹¹ Connor and Landes (2012) find that the median overcharge in scholarly studies of 1,517 estimates of cartel overcharges is 23.3% over all time periods and cartels and is higher, at 30.0%, for international cartels. Connor, John M. and Robert H. Lande, 2012, *Cartels as Rational Business Strategy: Crime Pays*, *Cardozo Law Review* Vol. 34, 427-490, p. 456. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1917657, accessed 02 April 2014.

- I include CDT sales occurring after 2008;
- I remove the squared demand terms (unemployment and LCD revenue share);
- I use lagged glass costs and demand variables instead of contemporaneous glass costs and demand variables;
- I end the cartel period at the announcement of the LCD investigation; and
- I maintain the cartel period from the Complaint but force the overcharge rate to be the same throughout the period.

For each sensitivity analysis the overcharge remains positive and significant for both CDTs and CPTs. The results of my sensitivity analyses are included in Exhibit 65.

C. Reliable application of widely-accepted economic principles and methods to the facts and data of the case yields a 25.0% overcharge for CDTs and a 9.5% direct overcharge for CPTs

Absent the availability of observations on but-for world CRT prices, I used regression analysis based on generally-accepted economic principles and methods applied to Defendants' CRT sales data, data on CRT supply and demand factors, and Defendant conduct to obtain a measure of the overcharge rate imposed on direct purchasers. The application of economically valid principles and methods in a manner consistent with practices in the field of economics to the case facts and data indicates that the cartel resulted in CDT overcharges of 25.0% for 1995Q2 to 2006Q4 and 12.3% for 2007Q1 to 2007Q4 and overcharges of 9.5% and 3.2% on CPTs.

X. Calculating the pass-through rate

In Section VIII.B I established that at least some portion of the overcharge to direct purchasers was passed through to class members, which is sufficient to establish that the cartel injured class members. In order to calculate damages to class members, I estimated of the extent to which the overcharge was passed through to class members (that is, I measured the extent to which changes in the price of CRTs translate into changes in the price for CRT monitors and TVs). Below I describe evidence (data) and a method to estimate the pass-through rate.

A. Data used to estimate pass-through

The data used for the econometric studies of pass-through included the prices at which CRTs and CRT products were bought and sold throughout the distribution channel. Ideally one would be able to isolate the change in price resulting from the cartel's behavior. This would require that prices rise on the first day of the cartel to the cartel level and fall on the last day of the cartel to the but-for level, while all else is held constant. These conditions, however, do not hold. I therefore based my estimate of the pass-through rate on observations on how firms set price based on cost; these data provided a reasonable proxy for how retail prices to class members would change in the face of cartel overcharges.

The data I used to measure pass-through contained a variety of ordinary cost and price levels and cost and price changes faced by CRT resellers. For each data set, I used all the usable data. Because these data are for all sales from a given reseller for a particular point in time, the data are likely to include cost changes that apply to all resellers and some that do not, cost changes both large and small, and cost changes both temporary and non-transitory. As I described in

Section VIII.B.1.b), cost changes are more likely to be passed through the more of the industry that faces the cost change, the larger the cost change, and the longer the cost change is expected to last. The data I employ for my studies provide a conservative estimate of the pass-through rate. That is, small, temporary, and firm-specific cost changes are less likely to be passed-through; therefore, including these observations in the pass-through studies will yield conservative estimates of the pass-through coefficient. Even though these data contain all types of cost changes, they can still be used as a basis for an economically meaningful measure of the pass-through rate.

To obtain an economically reasonable estimate of the pass-through rate, it is neither feasible nor necessary to measure pass-through for every individual firm in the distribution channel. There are many firms that participate in the production and distribution of CRT products, and not all of them maintain the data necessary to measure pass-through. Many resellers are located outside the U.S. and I understand are not obligated to respond to Plaintiffs' subpoenas requesting data. Some resellers no longer exist, nor do data on their past sales. One can calculate pass-through on an economically sound basis by obtaining data from a sample of the firms in the distribution channel, which is the approach that I used. At my direction and that of my staff, Plaintiffs' counsel has subpoenaed a range of different types of firms (e.g., "big box" stores, online retailers) operating at all levels of the distribution channel (e.g., product manufacturers, retailers), selling all types of at-issue CRT monitors and TVs. Using these third-party data produced in response to Plaintiffs' subpoenas, as well as other data produced by Defendants or plaintiffs in other, related cases, I have completed a considerable number of pass-through studies using data that represent the pricing decisions made by the various types of CRT resellers operating throughout the distribution channel. I understand that discovery does not close until September 5, 2014,³¹² and I reserve the right to supplement my analysis as new data becomes available.

In order to use regression analysis, the data must include variations in price and in cost.³¹³ There are two types of data variation I can use: variations over time and variations over the cross-sectional unit; one can estimate pass-through using data containing either, or both, type of variation.

Data containing variations over time allow me to observe the sale of a specific CRT at different points in time. Data containing cross-sectional variation allow me to observe, for example, monitors containing different CRTs sold by the same retailer at a given point in time. If there is variation in the cost of the CRT, either over time for the same product or over different products, I could estimate the pass-through rate. Because both of these types of data can provide the necessary information to estimate pass-through, ignoring either type results in a pass-through estimate that is not based on all the available evidence in this matter.

Time series data control for differences in the cross-sectional unit. That is, in looking at the same product sold at the same outlet over time, I do not have to contend with differences in products

³¹² 03 January 2014, Stipulation and Order Regarding Scheduling, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division), at 2

³¹³ In other words, knowing only that a product sells for \$100 and costs \$50 is not informative of the pass-through rate, even if one observes that same combination of cost and price over time, suppliers, and/or buyers. These hypothetical data simply show that the price of the product is twice as large as the cost; there is no variation in cost or price from which one could draw meaningful conclusions regarding the impact of cost changes on price.

and/or outlets that may also impact price. However, when observing changes in prices and costs over time, not only is the cost changing, but other factors are changing too, such as the quality of the product relative to other available products.³¹⁴

In contrast, cross-sectional data control for changes over time, such as the relative quality of the product, which may impact price. However, when observing multiple products or a product sold at multiple outlets at a single point in time, there may be differences across products and/or across outlets that may have an impact on price as well as on cost. For example, the same TV model will be more expensive at a local electronics store with knowledgeable salespeople and extensive displays than the same TV at Costco, which has minimal sales assistance and minimal displays.³¹⁵

As a third alternative, economists often use what is referred to as panel data, which contain variation across time and across a cross-sectional unit.

Typically an economist will use whatever data are available, specifying the regression to the specific characteristics of the data available. For example, if one uses cross-sectional units, one can include variables to control for differences in cross-sectional units, and if one uses time-series data, one can include variables to control for changes that take place over time.

When estimating the pass-through rate, one should make use of all the available types of evidence and all of these types of data provide insight regarding how firms will pass-through cost changes. In my studies, I followed this strategy. That is, I used whatever data were available, whether they have cross-sectional variation, time-series variation, or both, and control for other effects as appropriate.

B. Econometric design

1. The basic pass-through regression

The pass-through rate can be estimated by regressing the price of the CRT product on the cost of the CRT.³¹⁶ Mathematically, the regression equation for these studies can be represented by

³¹⁴ See, e.g.,

- A spreadsheet tracking the average street prices of CRT TVs lists a Philips 30PW8502 television as having an average street price of \$1,299.99 in June 2004. In September 2005, the average street price had decreased to \$997.97. Chunghwa Picture Tubes, LTD, 20 September 2005, TV Price Summary, CHU00303245.
- Another spreadsheet tracking the average street prices for CRT TV categories shows that only regular, round, standard definition CRT TVs were available in 1998. Beginning in 1999 and 2000, flat screen CRT TVs were introduced, and in 2002 wide screen, flat screen, high-definition ready TVs were being produced. Matsushita Display Devices (America), Undated, Price Spreadsheet, MTPD-0086013.

³¹⁵ For example, in July 2005, Costco sold Philips 27PT543S televisions for \$180, while Best Buy sold the same model for \$220. Chunghwa Picture Tubes and LTD, 20 September 2005, TV Price Summary, CHU00303245.

³¹⁶ The approach of regressing price on cost to estimate the pass-through rate is commonly used in the academic literature. See, e.g.,

- Doyle, Maura P., July 1997, The Effects of Interest Rates and Taxes on New Car Prices, Board of Governors of the Federal Reserve System Finance and Economics Discussion Series 1997-38.

$$\text{price} = \alpha + \beta \text{ cost} + \varepsilon \quad \text{or} \quad p = \alpha + \beta c + \varepsilon,$$

where p is the price of the CRT product, c is the cost of the CRT, and ε represents the error term. In this equation, the pass-through rate, which is equal to the derivative $\partial p / \partial c$, is equal to β ; that is, the coefficient on the cost variable gives the pass-through rate.

The regression can be used to estimate the pass-through rate for the entire distribution channel or a portion of it. In either case, the price paid by the downstream purchaser (which could be a product manufacturer, a distributor, a reseller, or an end customer) for whatever item the downstream purchaser buys (it could be a CRT or it could be a product containing a CRT) is regressed on the upstream cost of either the CRT or the CRT product. In each case, the coefficient (β in the equation above) on the upstream cost variable gives the pass-through rate.

In the regressions as applied to the CRT industry, the cost variable that is used generally captures the majority of the cost of the item that is being sold. For example, when a firm is a product distributor or a retailer, the cost included in the regression is the entire cost of the CRT product, be it a monitor or TV. When a firm is a product manufacturer, the cost included is the cost of the CRT,³¹⁷ which is a substantial portion of the cost of both TV and monitors.³¹⁸

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- Stennek, Johan and Frank Verboven, 03 May 2001, Merger Control and Enterprise Competitiveness - Empirical Analysis and Policy Recommendations, Research Institute of Industrial Economics Working Paper No. 556.
 - See also footnote 334.

³¹⁷ The cost data provided by some product manufactures included the cost for the complete finished CRT product. This is likely due to the fact that some product manufactures outsource the manufacturing of some products.

³¹⁸ See, e.g.,

- CRT TVs:
 - The CRT accounts for approximately 50% of the total value of the components in a finished television. U.S. International Trade Commission, May 1995, Industry Trade Summary: Television Picture Tubes and Other Cathode-Ray Tubes, USITC Publication 2877, http://www.usitc.gov/publications/docs/pubs/industry_trade_summaries/PUB2877/PUB2877.PDF, accessed 15 March 2012, at 1.
 - LGE testified that CRTs account for approximately 50% of the total value of the components in a finished CRT TV. LGE 30(b)(6) Deposition of Kyung Tae Kwon, 13 July 2012, at 54:22-25.
 - Another LGE employee estimated that CRTs accounted for between 60%-70% of the total component cost of CRT TVs. LGE 30(b)(6) Deposition Yun Seok Lee, 11 July 2012, at 72:14-18.
 - Toshiba testified that CRTs account for approximately 60%-65% of the total value of the components in a finished CRT TV. 01 August 2012, Deposition of Toshiba Corporation and Toshiba America Consumer Products 30(b)(6) Witness Yoshiaki Uchiyama (Hereinafter "Toshiba 30(b)(6) Deposition of Yoshiaki Uchiyama, 01 August 2012"), at 38:10-17 and 39:9.
 - DisplaySearch data covering 2006Q1 through 2008Q1 show that the CRT accounts for approximately 52% of the total value of the components in finished 21-22" CRT TVs; 66% of 25-29" TVs; and 70% of 30-34" TVs. DisplaySearch, April 2008, Quarterly CRT TV Cost & Price Forecast Model Report, Q1'08 History with Q2'08-Q4'12 Forecasts, SDCRT-0002416.
- CRT Monitors:
 - Hitachi testified that CRTs account for approximately 45% to 55% of the total value of the components in a finished monitor. 12 July 2012, Deposition of Hitachi, Ltd. 30(b)(6) Witness

2. Other determinants of price

Price and cost are the necessary variables for the calculation of the pass-through rate, but it is likely that product characteristics (e.g., screen size) have an impact on the price level. I included variables to control for different product characteristics to the extent possible given the data. The variety and detail of each dataset determine which characteristics can be reliably controlled for in each study. I estimated separate regressions for each application and, whenever possible, controlled for the following product attributes: screen size, CRT manufacturer, resolution, high definition, and flat screen.³¹⁹ These product attributes were selected based on industry documents, which commonly classified products using these criteria.³²⁰

Including additional regressors in the analyses does not affect the interpretation of the coefficient on the cost variable as the pass-through rate; rather, the inclusion of these additional regressors is a variation on the same method of regressing downstream price on upstream cost. The purpose of adding additional regressors is to account for the unique characteristics inherent in each dataset. As stated above, I controlled for the same product attributes whenever the data allowed; however, not all datasets contained identical information on CRTs or CRT products.³²¹

3. Is the entire overcharge passed through?

Because the distribution channel is highly competitive, I expect to find that pass-through is close to 100%, for the reasons described in Section VIII.B.2. Therefore I tested whether, in each econometric study, the estimated pass-through rate is statistically significantly different than

Yasu Hisa Takeda, Volume I (Hereinafter “Hitachi 30(b)(6) Deposition of Yasu Hisa Takeda, Vol. I, 12 July 2012”), at 11:21-12:2.

- LGE testified that CRTs account for approximately 50% of the total value of the components in a finished monitor. 09 July 2012, Deposition of LG Electronics 30(b)(6) Witness Mok Hyeon Seong (Hereinafter “LGE 30(b)(6) Deposition of Mok Hyeon Seong, 09 July 2012”), at 108:23-109:9.
- LGE testified that CRTs account for approximately 60% of the total value of the components in finished monitors. LGE 30(b)(6) Deposition of Kyung Tae Kwon, 13 July 2012.

³¹⁹ Not all datasets provide sufficient detail to control for these attributes. Some datasets provide additional information, allowing me to control for additional attributes including, but not limited to, the presence of the following: VCR or DVD TV combinations, wide screen, HD-ready, picture-in-picture, and re-manufactured/refurbished products.

³²⁰ Although there are other product characteristics, application, size, resolution, and manufacturer are the characteristics commonly used to differentiate CRTs.

- A DisplaySearch spreadsheet lists CRT televisions and their characteristics, including size, manufacturer, resolution/high definition, aspect ratio, and CRT technology (including whether it is a flat screen CRT). Chunghwa Picture Tubes, LTD, 20 September 2005, TV Price Summary, CHU00303245.
- In the cartel meeting notes, Defendants routinely refer to application, size, finish, and manufacturer when discussing CRTs. See Exhibit 1.

³²¹ For example, some of the datasets I employed are for CRT TVs and contain information on whether the product contained a built-in VCR or DVD player, whereas other datasets contain only sales for CRT monitors. With TVs, it makes sense to control for VCR/DVD combo; with monitors, it does not.

100%.³²² For those studies with results that are statistically significantly different from 100%, I then tested whether or not they were statistically significantly less than or greater than 100%.³²³

As I explained in Section VIII.B.2.a) when distribution firms operate in a perfectly competitive industry with constant costs, the theoretical pass-through rate is 100%. Because the distribution firms operate in a highly, but not perfectly, competitive industry, the pass-through rate calculated from the data may be greater than or less than 100%.

C. Summary of econometric estimates of pass-through

I conducted 62 empirical pass-through studies to calculate pass-through rates by application; that is, I calculated separate pass-through rates for monitor tubes (CDTs), TV tubes (CPTs), monitors, and TVs. I used data produced by Defendants as well as resellers of CRTs or CRT products and market research firms. Some of the data were actual transaction-level data or based on transaction-level data, meaning they represented the actual amount paid by the purchaser, while some of these data were price lists or price guidelines from which actual transaction prices were derived.

1. Wal-Mart

To illustrate the method used to calculate the pass-through rate and to demonstrate the usefulness of different types of data, I describe in detail three pass-through studies using different data sources for sales of CRT products at Wal-Mart. The datasets I used each contain purchases and sales of CRT products by Wal-Mart: two of the datasets were produced by Wal-Mart³²⁴ and one was produced by Sanyo, one of Wal-Mart's suppliers. These files include different cost and price variables, all of which provide useful information pertaining to Wal-Mart's pricing practices and for measuring Wal-Mart's pass-through rate. These studies show that various types of price and cost data can be combined to measure pass-through.³²⁵

³²² To test whether or not the pass-through rate is statistically significantly different from 100%, I used a Wald test and a significance level of 10%. Wooldridge, Jeffrey M., 2000, *Introductory Econometrics*, South-Western College Publishing, at 116-133.

³²³ Before testing whether the estimated pass-through rate is equal to or different from 100%, I determined whether the data are homoskedastic (which means the error term of the regression has a constant variance). If not, I estimated the regression using White's robust standard errors. See, e.g.,

- Wooldridge, Jeffrey M., 2000, *Introductory Econometrics*, South-Western College Publishing, at 248-249.
- Breusch, T.S., and A.R. Pagan, September 1979, A Simple Test for Heteroskedasticity and Random Coefficient Variation, *Econometrica*, Vol. 47, 1287-1294.
- White, Hal, 1980, A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity, *Econometrica*, Vol. 48, 817-838.

³²⁴ Wal-Mart also produced data for sales through Sam's Club. I completed two studies using the Sam's Club data, which are reported in Section X.C.2 and Exhibits 62 and 63. The results of the Sam's Club studies are consistent with the Wal-Mart study results.

³²⁵ In some data sets the cost and price of the items sold in each individual transaction are provided; I refer to these datasets as having matched costs and prices. In these data, the cost that accompanies any given sale price is known. For other data, it is necessary to match the appropriate cost with the appropriate price for each observation. For example, many firms provided purchase data containing product costs in one dataset and provided sales data containing product prices in a different dataset. In these instances, it was necessary to match these data, ideally by each individual product and date.

The files that were used for these studies, which were provided by Wal-Mart, included actual transaction-level cost and prices as well as Wal-Mart's retail prices at the time it purchased products. I also used price lists provided by Sanyo for sales of CRT products to Wal-Mart. Transaction-level data in theory record the actual amount paid by purchasers, but these data often include extraneous information that may not accurately represent the price of an item for some transactions.³²⁶ Price lists or suggested retail prices may not reflect the actual amount a customer paid for an item, but they do provide a starting point for any price negotiations, discounts, etc., all of which are informative of a seller's pricing practices.

In the first study, I used TV purchasing data produced by Wal-Mart. These data included Wal-Mart's weekly cost for each item,³²⁷ and a "Retail Amount" variable, which is a measure of the retail price for each item.³²⁸ The data were in a form in which the cost and price variables were already matched. I regressed the retail price on the cost for the TV, controlling for size and other product characteristics (manufacturer, high-definition, and TV-VCR combo). Using these data, I calculated a 110% pass-through rate. The interpretation of these results is that when Wal-Mart's cost for TVs increased by \$1.00, the Wal-Mart increased the price it charged its customers increases by \$1.10.

In the second study, I used the same purchasing cost data, but I matched these costs to the daily sales data produced by Wal-Mart; that is, I used price data based on store-level transactions.³²⁹ In order to combine the data from these two sources, I calculated average weekly per-unit costs for each product, which I then matched with Wal-Mart's daily sales data. As before, I regressed the price on the cost for each item, controlling for size and other product characteristics (manufacturer, high-definition, TV-VCR combo, and month). Using these data, I calculated a

³²⁶ For example, a retail customer may have store credit which may be applied to the purchase price of an item. Also, it is not uncommon to observe a sales price of one cent in transaction-level data for various reasons (e.g., exchanges for defective products) but these transaction amounts are not indicative of the actual price of the item. There are many other scenarios which may distort the prices recorded in these transaction level data.

³²⁷ See, e.g.,

- Wal-Mart produced weekly purchase data covering 11 October 2008 through 13 August 2010. Fields include the year-week, the week's beginning and ending dates, item number, item description, UPC (Universal Product Code, a unique product identifier), UPC description, vendor name and number, the gross purchase quantity, the gross purchase cost, and the gross retail (price) amount. Wal-Mart, 2010, Walmart and Sams Select Gross Ships Report 102008-102010, <<Walmart and Sams Select Gross Ships Report 102008-102010 LR35847.xls>>.
- Wal-Mart produced additional weekly purchase data covering the 21st week of 2001 through the 34th week of 2008; these data were disaggregated by store. Fields include the store number, vendor name and number, item description, item number, year-week variable, per-unit retail (price) amount, per-unit purchase cost, and purchase quantity. Wal-Mart, 2010, Sams and WMT Selected Gross Ships Report LR35989, <<Sams and WMT Selected Gross Ships Report LR35989 (1).xls>>.

³²⁸ Per an e-mail sent by Brian Hennelly to Brian Umpierre on 11 September 2013, the price variable in Wal-Mart's purchase data (named *Gross Ship Retail \$*) "is calculated on the basis of the retail price at the time the product was received at the store." Hennelly, Brian, 12 September 2013, E-mail, Subject: Fwd: In re Cathode Ray Tube (CRT) Antitrust Litig., Case No. 07-5944 (N.D. Cal.).

³²⁹ Wal-Mart produced daily sales data for selected stores beginning on 14 January 1995 and ending on 6 October 2010. Fields include the date, the store number, the item number, item description, UPC, UPC description, vendor name and number, sales quantity, and sales amount in dollars. Wal-Mart, 2010, Walmart and Sams Selected Sales Report, <<Walmart and Sams Selected CRT Sales Report LR35846.xls>>.

106% pass-through rate. The interpretation of these results is that when Wal-Mart's cost for TVs increased by \$1.00, Wal-Mart increased the price it charged its customers by \$1.06.

In the third study, I used annual price lists provided by Sanyo for TVs sold from Sanyo Manufacturing Corporation to Wal-Mart between 1995 and 2007.³³⁰ These data included an "FOB Cost" variable which represented Wal-Mart's cost to purchase products from Sanyo; these costs were already matched to the Wal-Mart suggested retail price. I regressed Wal-Mart's suggested retail price on Wal-Mart's FOB Cost controlling for the size of the TV and other features (flat screen, wide screen, HDTV, and picture-in-picture). Using these data, I calculated a 116% pass-through rate. The interpretation of these results is that when Wal-Mart's cost for TVs increased by \$1.00, Wal-Mart increased the price it charges its customers increases by \$1.16.³³¹

While each of these studies used different data representing the cost and price at which Wal-Mart purchases and sells CRT products, these data all illustrate the pricing behavior of Wal-Mart. By analyzing these various data sources, I showed that Wal-Mart passed through cost increases to its customers at a rate over 100%. This conclusion holds whether one examines data on suggested retail prices, wholesale list prices, or actual transaction data.³³² Additionally, I have completed two additional studies, one top-to-bottom study and one top-and-bottom study, both of which used data provided by Sanyo involving products sold at Wal-Mart and likewise yield consistent results; see Section X.C.2 below.

2. Other studies

In addition to the Wal-Mart studies discussed above, I conducted 59 additional pass-through studies, which fall into three general categories: those that measure pass-through over the entire distribution channel, those that measure pass-through over multiple levels of distribution, and those that measure pass-through for an individual level of distribution.

³³⁰ This file contained prices and costs for Sanyo televisions sold through Wal-Mart. There was a separate price list for each year, beginning in 1995 and ending in 2007. Generally, each year contained Wal-Mart's model number, the suggested retail price at which Wal-Mart listed the product, the percent mark-up, Wal-Mart's FOB costs, an "effective date" on which price changes took effect, and a column for notes and comments about the price change. Some pages also contain a Wal-Mart item number (Wal-Mart's in-house SKU) and a group description that specifies the size of the TV as well as some other characteristics. Sanyo, 04 March 2011, CRT Pricing Info (1995-2007), <<CRT Pricing Info (1995-2007).PDF>>.

³³¹ I was also able to conduct a Sanyo product manufacturer pass-through study using these data and other data produced by Sanyo. I matched Sanyo's tube purchase data with FOB costs for Sanyo finished CRT products from Wal-Mart's price list, finding a pass-through rate of 150%.

³³² Similarly, I conducted multiple studies for Dell and Target that use different measures of costs and prices in each, yet yield similar results:

- Dell provided different datasets with two different measures of cost: one is purchase data with actual procurement costs, and the other is an accounting cost measure. In a letter from Rodney Ganske, Dell states that the accounting cost measure (a variable named *total_cost_usd*) "represents the measure of Cost Dell paid for the related SKU item in an order during the time period of sale." Ganske, Rodney J., 22 May 2013, Letter, Re: Dell CRT Data Questions, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division).
- Target provided data with two different measures of price: one is a suggested price and the other is based on actual transactional prices.

As described in Section X.B, there are two approaches for estimating pass-through over the entire channel: by looking at the relationship between costs at the top of the distribution chain and prices at the bottom of the distribution chain (which I call the top-and-bottom approach) and by estimating the pass-through rate at each level of the distribution chain and then multiplying them (which I call the top-to-bottom approach). The top-and-bottom approach directly calculates the pass-through rate over the entire distribution channel, which I refer to as the channel-length pass-through rate.

The top-to-bottom approach calculates separate pass-through rates for individual levels of the distribution channel; the channel-length pass-through rate is obtained by multiplying all of the pass-through rates for the individual levels. For example, consider the following distribution chain in which tube manufacturer A sells tubes to tube distributor B. Tube distributor B then resells the tubes to finished product manufacturer C to manufacture CRT TVs. Product distributor D then buys those TVs from finished product manufacturer C and sells them to retailer D. Retailer D, in turn, sells them to end users. This example has four levels of distribution (tube distributor, finished product manufacturer, finished product distributor, and retailer) and I can calculate a separate pass-through rate for each. If the individual pass-through rates are 115% for tube distributor A, 109% for finished product manufacturer B, 100% for finished product distributor C, and 104% for retailer D, then the channel-length rate is 120%. The cumulative pass-through rate can be calculated by multiplying the pass-through rates at each level: $115\% \times 109\% \times 100\% \times 104\% = 130\%$. See Exhibit 66.

The top-and bottom approach calculates a single pass-through rate over the entire distribution channel by using data at the top of the channel on tube prices and data at the bottom of the channel on retail prices paid by end users for monitors or TVs that include a CRT. For example, a tube manufacturer initially increases the price of a tube by \$1.00 and in response a retailer selling finished TVs that use those same tubes increases its price by \$1.20, the channel-length pass-through rate is 120%. See Exhibit 67.

Both of these approaches were implemented using the same initial cost data, i.e., CRT prices charged by Defendants to direct purchasers at the top of the channel; however, different data were used at the bottom of the channel. The top-and-bottom approach used retail or “street” prices for products being sold to end-users as the downstream price.^{333,334} The top-to-bottom

³³³ The top-and-bottom approach does not use data from intermediate resellers. The pass-through rates of intermediate resellers are subsumed within the analysis. This approach estimates a single pass-through coefficient for the entire distribution channel.

³³⁴ Estimating the pass-through rate for an entire distribution chain by looking at the prices at the top and bottom of the distribution chain is common in the peer-reviewed, published, scholarly economic literature. See, e.g.,

- Aaronson, Daniel, February 2001, Price Pass-through and the Minimum Wage, *The Review of Economics and Statistics*, Vol. 83(1), 158-169.
- Gron, Anne and Deborah Swenson, May 2000, Cost Pass-Through in the U.S. Automobile Market, *The Review of Economics and Statistics*, Vol. 82(2), 316-324.
- Kadiyali, Vrinda, 1997, Exchange Rate Pass-through for Strategic Pricing and Advertising: An Empirical Analysis of the U.S. Photographic Film Industry, *Journal of International Economics*, Vol. 43, 437-461.
- Karp, Larry S. and Jeffrey M. Perloff, March 1989, Estimating Market Structure and Tax Incidence: The Japanese Television Market, *The Journal of Industrial Economics*, Vol. 37(3), 225- 239.

approach incorporated data from multiple levels of the channel including as many intermediate resellers as necessary to trace specific products through the entire distribution chain from the CRT manufacturer to the end customer.³³⁵

I conducted three top-and-bottom studies, each of which span the entire distribution channel:

- For the first study, I used data on Sanyo's purchase of tubes from Defendants at the top of the channel matched to Wal-Mart's price list containing the retail prices for Sanyo finished CRT products sold in Wal-Mart stores. I calculated a pass-through rate of 185%; see Exhibit 68.
- For the second study, I used tube sales data from Panasonic at the top of the channel matched to TV sales data from Bestbuy.com at the bottom of the channel. The Bestbuy.com data were limited to Panasonic-brand finished products, which were likely to contain Panasonic tubes.³³⁶ Panasonic's tube sales data were aggregated by month, size, shape (round or flat screen), and aspect ratio. These data were matched to Bestbuy.com's transaction-level retail sales data by month, size, shape, and aspect ratio. Controlling for screen size, screen shape, integrated VCRs and DVD players, and picture-in-picture capabilities, I calculated a pass-through rate of 115%; see Exhibit 68.

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- Leibtag, Ephraim, Alice Nakamura, et al., March 2007, Cost Pass-Through in the U.S. Coffee Industry, United States Department of Agriculture Economic Research Service Economic Research Report Number 38.
 - Nakamura, Emi and Dawit Zerom, August 2009, Accounting for Incomplete Pass-Through, NBER Working Paper 15255, <http://www.nber.org/papers/w15255>.
 - Radchenko, Stanislav, 2005, Lags in the Response of Gasoline Prices to Changes in Crude Oil Prices: The Role of Short-Term and Long-Term Shocks, *Energy Economics*, Vol. 27, 573-602.
 - Sumner, Daniel A., October 1981, Measurement of Monopoly Behavior: An Application to the Cigarette Industry, *The Journal of Political Economy*, Vol. 89(5), 1010-1019.

³³⁵ This approach required being able to identify the customers across datasets as well as trace products across datasets, preferably by manufacturer part number and date.

³³⁶ See, e.g.,

- The vendor for all Panasonic-brand TVs in Best Buy.com's data was Panasonic North America (PNA). See Best Buy, Undated, SKU List, BBYCRT000080.
- All finished products sold by PNA originated from its Mexican factory, referred to as PAVCA/MTNC: "Q. The televisions that you bought and then sold to your customers, they all came from Panasonic Corporation; is that correct? A. They came from MTNC, which is our factory in Mexico so... Q. Were all the televisions you sold manufactured in the same location? A. Yeah, they were all out of Mexico. As far as I know, they were all out of Mexico." 18 July 2012, Deposition of Panasonic North America 30(b)(6) Witness Edwin Wolff (Hereinafter "Panasonic 30(b)(6) Deposition of Edwin Wolff, 18 July 2012"), at 49:15 - 50:2.
- All TVs produced at PAVCA/MTNC were sold to PNA: "Q. Did all of the CRT TVs that PAVCA produced get sold to PNA? A. That is correct, for American business." Panasonic 30(b)(6) Deposition of Mishiro Kimura, 19 July 2012, at 40:11 - 13.
- PAVCA/MTNC sourced 70% of its tubes from Panasonic: "Q. Can you give your best estimate on the percentage of time where the specifications were similar enough that the tubes could be substituted? A. [...] [O]f all of the CRTs, around 70 percent came from MTPDA while around 30 percent came from Samsung and others." Panasonic 30(b)(6) Deposition of Mishiro Kimura, 19 July 2012, at 93:20 - 94:6.

- For the third study, I used tube sales data from Samsung at the top of the channel matched to TV sales data from brick-and-mortar Best Buy stores at the bottom of the channel. The Best Buy data were limited to Samsung-brand finished products, which are likely to contain Samsung tubes.³³⁷ Samsung's tube sales data were aggregated by month, size, shape (round or flat screen), and aspect ratio. These data were matched to Best Buy's transaction-level retail sales data by month, size, shape, and aspect ratio. Controlling for screen size, HDTVs, flat screens, and integrated VCRs, I calculated a pass-through rate of 155%; see Exhibit 68.

I have conducted two top-to-bottom studies:

- For the first top-to-bottom study, I used data that traced sales of CRTs through the following resellers: TAEC, TACP, and Costco.³³⁸ I calculated a pass-through rate of 183%, which also spans the entire distribution channel; see Exhibit 69.
- For the second top-to-bottom study, I used data on Sanyo's purchase of tubes from Defendants at the top of the channel. I matched these data to a price list of Sanyo products sold in Wal-Mart stores, which include a measure of Wal-Mart's FOB costs for purchasing finished CRT products from Sanyo and Wal-Mart's retail prices for those products. I calculated a pass-through rate of 176%, which spans the entire distribution channel; see Exhibit 69.

The second general category of studies calculated pass-through over multiple levels of distribution, which I refer to as multi-level studies. These studies are similar to the top-to-bottom approach in that they calculate separate pass-through rates for each individual level and the multi-level rate is obtained by multiplying the pass-through rates for the individual levels. In the multi-level studies I traced pass-through for specific products; that is, I was able to match specific products across different datasets using individual product numbers. I conducted three multi-level studies; see Exhibit 70:

- In the first study, I used data on sales of televisions by Philips and Best Buy. Televisions in this study were manufactured by Philips, sold to Best Buy, and then resold to end-users. Both datasets were aggregated by item number and month and matched based on these criteria. I calculated a pass-through rate of 139% controlling for tube size and flat screen.
- In the second study, I used data on sales of televisions by Philips and Costco. Televisions in this study were manufactured by Philips, sold to Costco, and then resold to end-users. Both datasets were aggregated by item number and month and matched based on these criteria. I calculated a pass-through rate of 133% controlling for tube size and flat screen.

³³⁷ Samsung Electronics Corporation (SEC), Samsung's finished product manufacturing subsidiary, purchased nearly 87% of its tubes directly from Samsung tube manufacturers and Samsung sales organizations between 2001 and 2007. Approximately 79% were purchased directly from Samsung tube manufacturers. Samsung, 2007, Samsung Electronics Corporation Tube Purchase Data 2001-2007, SEC-CRT-00000014.

³³⁸ The data used for the tube distributor portion of this study, sales from Toshiba to TAEC, did not include sufficient information to control for product characteristics. In order to complete this study, I controlled instead for individual part numbers.

- In the third study, I used data on sales of monitors by Envision, Ingram Micro, and PC Connection. Monitors in this study were manufactured by Envision, sold to Ingram Micro, resold to PC Connection, and then resold to end-users. Each dataset was aggregated by item number and week and matched based on these criteria. I calculated a pass-through rate of 127% controlling for tube size.

Although the multi-level studies do not calculate a pass-through rate that spans the entire distribution channel, I can still make reasonable inferences about the channel-length rate. Specifically, consider the Philips-Costco study in which I calculated a pass-through rate of 133% from finished product manufacturer to end user. This study does not incorporate the tube distributor level from which Philips purchased tubes; however, in order for the channel-length pass-through rate to be less than 100%, the rate for the missing tube distributor level would have to be less than 75%, which is considerably lower than any of the pass-through rates I have calculated.

The third general category of studies calculated pass-through for a single level in the distribution channel. I conducted two pass-through studies using data provided by a CRT distributor (two because I calculated a separate pass-through rate for CDTs and for CPTs), eleven studies using data provided by CRT product makers, four studies using data provided by CRT product distributors, and 37 pass-through studies using data provided by CRT product resellers (nineteen of these studies were for brick and mortar retailers and eighteen were for online retailers).³³⁹

Exhibit 62 lists the calculated pass-through rates and other statistical results for each of the studies I have conducted. Exhibit 63 provides information about the firms, the data they provided, and the specification for each of the studies I have conducted. Exhibit 71 lists the files relied upon for each pass-through study.

Exhibits 72-74 plot the calculated pass-through rate and corresponding 95% confidence interval for each of the studies.³⁴⁰ All 62 of the confidence intervals either include 100% or are wholly

³³⁹ See, e.g.,

- Tube distributors: Toshiba America Electronics Corporation (TAEC).
- CRT product makers:
 - Monitors: BenQ, Envision, Philips, Tatung, Toshiba America Information Systems (TAIS), and ViewSonic are monitor makers that provided data.
 - TVs: Funai, Philips, Sanyo, Sharp, and Toshiba America Consumer Products (TACP) are TV makers that provided data.
- CRT product distributors: Arrow Electronics, Ingram Micro, and Tech Data.
- CRT product resellers:
 - Brick-and-mortar retailers: Best Buy, Costco, Fry's, Kmart, Office Max, RadioShack, Sam's Club, Sears, Target, and Wal-Mart are brick-and-mortar retailers that provided data. These brick-and-mortar stores have an online presence as well.
 - Online retailers: Amazon, Best Buy.com, Buy.com, CDW, Dell, Gateway, PC Connection, PC Mall, and Zones.

³⁴⁰ A 95% confidence interval is a range that is expected to contain the actual value of interest (in this case, the pass-through rate) 95% of the time the range is estimated. Wooldridge, Jeffrey M., 2000, *Introductory Econometrics: A Modern Approach*, South-Western College Publishing, at 134.

above 100%. The 51 studies with confidence intervals wholly above 100% are the studies that find a pass-through rate that is statistically significantly greater than 100%. The remaining eleven studies with confidence intervals that include 100% are the studies that result in pass-through rates that are not statistically significantly different from 100%. None of the confidence intervals are wholly below 100%, meaning none of the studies result in a pass-through rate that is statistically significantly less than 100%.

D. Channel coverage

I conducted studies for all of levels of the distribution channel as described in Section VI.E. In Exhibit 75 I summarized which segments of the distribution channel were covered with each study. I presented five studies that measured pass-through from Defendants selling CRTs at the top of the channel to end customers purchasing CRT products at the bottom of the channel, and I presented three studies that measure pass-through for part of the distribution channel. Collectively, these studies covered the entire distribution channel and portions of the distribution channel, included both types of at-issue CRT products, and represented all the various types of buyers and resellers operating in the distribution channel. The total number of CRTs with unique price-cost combinations represented in these datasets was over 176 million.³⁴¹ These datasets included transactions beginning as early as February 1994 and continuing into November 2011. Exhibits 76-78 summarize the time periods covered by each study.

In an effort to obtain data that included transactions typical of those made by indirect purchasers represented in this matter, I compiled a list of third-party firms for Plaintiffs' counsel to subpoena for data that could be used to calculate pass-through rates; I specified the type of data that were needed, the format, period covered, and products included. Additional data were also provided by Defendant and Defendant-related entities through discovery. Some of the subpoenaed firms were unable to provide the requested data and some firms produced data that were insufficient to measure pass-through. For example, Zenith produced usable sales data, but was unable to provide any cost or purchase data. Similarly, some Defendants were unable to provide the data necessary to estimate pass-through and some Defendants produced data that was not usable. For example, Hitachi America Limited (HAL) provided data for finished goods sales; however, there is no variation in cost for each item over the entire period it was sold. In each of these instances, my staff attempted to work through counsel with the party producing the data in an effort to determine whether it could explain data deficiencies and/or produce additional data that would render the already produced data usable.

E. Summary: The pass-through rate is at least 100%

Based on economic theory and the results of the 62 econometric studies, I conclude that any overcharges were passed through to consumers at a rate of at least 100%. Of those studies, 51 found a pass-through rate statistically greater than 100% and eleven found a pass-through rate that was not statistically significantly different from 100%.

XI. Damages to class members are \$3.076 billion

³⁴¹ This number excludes tubes from the multi-level, top-and-bottom, and top-to-bottom studies. The total number of tubes including those datasets was over 191 million.

To calculate the damages that class members suffered as a result of the conspiracy, I multiplied the revenues received by Defendants and Co-conspirators from sales to class members by the overcharge and pass-through rates. The relevant CRT revenues are those that ultimately derive from class members' purchases of monitors and TVs containing CRTs.

A. Global CRT revenues

I began by estimating total global revenues for sales of CRTs by all manufacturers, including Defendants, Co-conspirators, and other manufacturers. The transaction data produced by Defendants are insufficient to estimate Defendants' global revenues. In particular, some Defendants have not produced any data³⁴² and other Defendants have produced data that do not cover all shipments of CRTs.³⁴³ I therefore estimated global CRT revenues by obtaining estimates of global CRT unit shipments from market research firms, which I then multiplied by average wholesale CRT prices based on data produced by Defendants.³⁴⁴ I estimated shipments, prices, and hence revenues separately for different sizes of CPTs (color picture tubes, the type of CRTs that are incorporated into TVs) and CDTs (color display tubes, the type of CRTs that are incorporated into computer monitors).³⁴⁵

1. Global CPT and CDT unit shipments by size and manufacturer

I used data from Defendants' internal documents detailing estimates of global sales to estimate annual global CPT shipments by size and manufacturer.³⁴⁶ I used similar documents, supplemented by NPD DisplaySearch reports,³⁴⁷ to estimate annual global CDT shipments by size and manufacturer.³⁴⁸ Some of the data are disaggregated by size and manufacturer in their

³⁴² Irco, Mitsubishi, Orion, Samtel, Thai-CRT, and Thomson/Videocon have not produced CRT sales data. See Section IX.B for further discussion on Defendant data production.

³⁴³ Some Defendants have not produced CRT sales data for one or more subsidiaries, e.g., Hitachi Singapore and Hitachi Malaysia. Other Defendant sales data are missing data for significant periods of time, e.g., the HEDUS data are missing the years 1995-1997 and the Philips data are incomplete for the years 1993-1999Q1 and absent completely for the time between 1999Q2 and the beginning of the LG-Philips joint venture in 2001.

³⁴⁴ Market research firms do not have data on global revenues.

³⁴⁵ I estimated shipments and prices separately for different sizes of CPTs and CDTs. The sizes of CPTs (in inches) are: 10, 11, 14, 15, 16, 17, 19, 20, 21, 22, 24, 25, 26, 28, 29, 32, 33, 34, 36, 37, and 38. The sizes of CDTs (in inches) are: 10, 12, 14, 15, 16, 17, 19, 20, 21, 24, 28, 29, 32, 34 and 36.

³⁴⁶ Worldwide shipments of CPTs:

- Hitachi Displays, 2002, Untitled Spreadsheet, HDP-CRT00019322.
- MT Picture Display, November 2006, Untitled Spreadsheet, MTPD-0416090, at Tab 'Supply DB'.

³⁴⁷ NPD DisplaySearch is a market research firm specializing in coverage of the display supply chain and related industries. It counts several Defendants among its clients. See footnote 280.

³⁴⁸ Worldwide shipments of CDTs:

- Hitachi Displays, 2002, Untitled Spreadsheet, HDP-CRT00019322.
- DisplaySearch, 2003, DisplaySearch Quarterly Desktop Monitor Shipment and Forecast Report Q1'03, CHWA00106460 - CHWA00106757.
- DisplaySearch, 2003, Quarterly Desktop Monitor Shipment and Forecast Report, CHWA00062147 - CHWA00062569.

original form. Where they are not, I estimated the disaggregation using supplemental data from Defendants' internal documents and NPD DisplaySearch.

These sources did not include data for global shipments of CDTs or CPTs in 2007. I estimated shipments in 2007 by using the data for other years to predict 2007 shipments. I used regression analysis of CDT and CPT shipments to estimate the time trend of shipments and then applied this trend to the 2006 data to estimate the volume of shipments in 2007.

2. Global CPT and CDT wholesale prices by size and manufacturer

To translate shipment sales to revenues, I used Defendants' sales data to estimate the annual price per tube for different sizes of CPTs and CDTs; see Exhibit 64 for a list of Defendants' sales data sources. For each size of CDTs and CPTs, I estimated the annual price by Defendant using each Defendant's own sales data. For manufacturers that did not produce sales data, I set annual prices by size equal to the average of prices as recorded in the Defendant sales data.³⁴⁹

3. Global CPT and CDT revenues by size and manufacturer

I multiplied the annual global unit shipments by size and manufacturer by the corresponding wholesale price to calculate annual total global revenues by manufacturer for each size CDT and CPT.

4. Adjustment for class period

I adjusted the global CPT and CDT revenue estimates in years 1995 and 2007 to account for the fact that the class period is March 1, 1995 through November 25, 2007. For each of these years, I multiplied global revenue estimates by the fraction of the year that is included in the class period.

B. Defendants' and Co-conspirators' global CRT revenues

Defendants and Co-conspirators accounted for a substantial majority of global CRT sales during the class period, but other firms produced CRTs as well. To estimate Defendants' and Co-conspirators' global CRT revenues during the damages period, I estimated annual global market shares by tube manufacturer. I then multiplied the market share by annual global revenues to arrive at global revenues for each Defendant and Co-conspirator.

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- DisplaySearch, 07 July 2005, Q2'05 Quarterly Desktop Monitor Shipment and Forecast Report, CHWA00088192 - CHWA00088762.
 - DisplaySearch, 30 September 2005, Q3'05 Quarterly Desktop Monitor Shipment and Forecast Report, CHU00281352 - CHU00281923.
 - DisplaySearch, 30 March 2007, Q1'07 Quarterly Desktop Monitor Shipment and Forecast Report, CHU00154037 - CHU00154420.
 - DisplaySearch, 28 September 2007, Q3'07 Quarterly Desktop Monitor Shipment and Forecast Report, LGE00076321 - LGE00076707.
 - Samsung, 11 December 2003, Worldwide CDT Manufacturer's Status, SDCRT-0201291.
 - Undated, CDT maker sales, CHU00071226.

³⁴⁹ I estimated average annual prices by size across all manufacturers by dividing total revenues by total shipments.

To estimate market shares, I used the same data sources that I used to estimate total global CRT shipments.³⁵⁰ These data contain Defendants' shares of global shipments rather than Defendants' share of global revenue; shipment shares differ from revenue shares to the extent that different manufacturers sold products at different wholesale prices. In order to convert quantity shares to revenue shares, I used average tube wholesale prices by Defendant by year, based on tube sizes sold by each Defendant.

1. Defendants' and Co-conspirators' shares of global CPT revenues

The CPT global unit shipment data include quarterly shipments by manufacturer for 1998 and 2000-2006. To estimate Defendants' market shares for 1995-1997, I set the market share equal to the 1998 value. To estimate Defendants' market shares for 1999, I used the weighted average market share for 1998 and 2000. To estimate Defendants' market shares for 2007, I used the share from 2006.

2. Defendants' and Co-conspirators' shares of global CDT revenues

The CDT global unit shipment data include annual shipments by manufacturer for 1996-1997 and quarterly shipments by manufacturer for 1998-2003 and 2004 Q2-2006. To estimate shares for 1995, I set each manufacturer's market share equal to its 1996 value. For 2004 Q1, I used the average of a firm's 2003 Q4 and 2004 Q2 market share. To estimate market shares for 2007, I used the share from 2006.

C. U.S. share of Defendants' and Co-conspirators' global CRT revenues

Next, I estimated the share of Defendants' and Co-conspirators' global CRT revenues that was attributable to sales of TVs and monitors in the U.S. Almost all of the available data on geographic shares of global CRT sales present data on CRTs that were consumed in the U.S. as part of sales to "NAFTA" or "North America".³⁵¹ To isolate U.S. consumption, I estimated the share of CPTs and CDTs consumed in the U.S. and Canada by estimating consumption when data were missing and excluding consumption in Mexico. I then excluded consumption in Canada to arrive at estimates of the share of CRTs consumed in the U.S.

This approach to estimating the amount of Defendants' and Co-conspirators' CRT revenues attributable to consumption in the U.S. assumes that the U.S. consumed the same mix of CPT and CDT sizes and types as the rest of the world. In fact, the U.S. likely consumed a higher proportion of larger, more expensive CRTs. For example, HDP-CRT00057341.xls contains estimates of demand for CPT by tube size and region. NAFTA countries (U.S., Canada, and Mexico) accounted for approximately half of demand for CPTs 30 inches or larger, but accounted for less than 20% of demand for all CPTs in the late 1990s. These data are insufficient to separately estimate the share of CPTs and CDTs by size that are consumed in the U.S. but they provide evidence that my approach tends to underestimate the share of large CRTs sold to the U.S. and overestimate the share of small CRTs sold to the U.S. The net effect should be to underestimate total revenues attributable to the U.S., and thus leads to a conservative estimate of the commerce affected by the CRT price-fixing cartel.

³⁵⁰ See footnotes 346 and 348.

³⁵¹ NAFTA and North America both include the U.S. and Canada and, depending on the source, sometimes Mexico.

1. Share of CPTs consumed in the U.S.

To calculate the share of worldwide CPT production ultimately consumed in the U.S., I started with data from two sources.³⁵² One source includes data on the share of CRT TV sales to the U.S., Canada, and Mexico for the years 1998-2000 and the other source includes data for the years 2004-2007. First, I excluded sales to Canada and Mexico. I then estimated the U.S. share for the missing years, 1995-1997 and 2001-2003.

I estimated each country's share of North American CPT consumption by calculating its share of nominal domestic demand measured in U.S. dollars at purchasing power parity.³⁵³ I then excluded the share of CPT revenue attributable to sales of TVs in Canada and Mexico.

To estimate the U.S. share of CPT consumption for 1995-1997, I used the 1998 share. To estimate the U.S. share for 2001-2003, I interpolated the missing years by assuming that the U.S. share declines linearly from the 2000 share of 16.0% to the 2004 share of 14.9%. See Exhibit 79.

2. Share of CDTs consumed in the U.S.

To calculate the share of worldwide CDT production ultimately consumed in the U.S., I started with data on the share of CRT monitors sold to the U.S. and Canada from 1999-2007.³⁵⁴ I excluded sales to Canada using the same method as for CPTs. I then estimated the U.S. share of CDT consumption for the missing years (1995-1998) by setting the share in those years equal to the share in 1999. See Exhibit 79.

D. Elimination of government purchases

Government entities are not a part of the class; therefore, I excluded U.S. revenues that are derived from government purchases. To calculate the share of revenues resulting from government purchases, I used data on the breakdown of computer sales between government entities and private consumers, which are available from the U.S. Bureau of Economic Analysis (BEA, part of the Department of Commerce).³⁵⁵ Using the BEA data results in a conservative estimate of class revenues for televisions because the government share of television purchases is likely to be smaller than the government shares of computer purchases. See Exhibit 79.

³⁵² North American shares of CPTs:

- Data from DisplaySearch contain shipments of TVs to the U.S. and Canada for the years 2004-2010. DisplaySearch, May 2011, Analysis Group, Inc. Custom Data Project, DISP_LCD_000129.
- Data from the Japanese Electronics and IT Industries Association contain shipments of CPTs to the U.S., Canada, and Mexico for the years 1998-2000. Japanese Electronics and IT Industries Association, June 2001, Worldwide CPT Demand by Area, HDP-CRT00057341.

³⁵³ Domestic demand is the sum of consumer spending, government spending, and business spending. It is also equal to gross domestic product (GDP) less net exports and change in inventories. I obtained the data from the OECD. OECD.StatExtracts, Undated, National Accounts, http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE1, accessed 01 October 2013.

³⁵⁴ North American shares of CDTs:

- Data from DisplaySearch contain shipments of computer monitors to the U.S. and Canada for the years 1999-2010. DisplaySearch, May 2011, Analysis Group, Inc. Custom Data Project, DISP_LCD_000129.

³⁵⁵ Bureau of Economic Analysis, 28 April 2011, Final Sales of Domestic Computers, <http://www.bea.gov/national/xls/comp-gdp.XLS>, accessed 12 May 2011.

E. Revenues from class members

Only residents living in certain states are part of the Indirect Purchaser State Classes.³⁵⁶ In order to calculate the share of Defendants' and Co-conspirators' non-governmental U.S. revenue that accrues from sales in Class States, I assumed that CRT end-product sales are distributed across states according to population. That is, I allocated the total non-governmental U.S. revenues to class states based on population shares.³⁵⁷

Using this process, I estimated that, over the entire class period, 8.6%³⁵⁸ of Defendants' and Co-conspirators' worldwide CRT revenue is attributable to indirect purchases by class members. See Exhibit 79. This amounts to a total of \$17.5 billion of revenue attributable to purchases by class members. See Exhibit 80.

F. Total damages

In order to calculate dollar overcharges to direct purchasers, I multiplied the total annual class tube revenues by the annual overcharge percentages, which are discussed in Section IX. I calculated dollar overcharges separately for each application type (CPTs and CDTs) as well as separately for two groups of CRT manufacturers, Defendants and Co-conspirators. In order to convert these direct purchaser dollar overcharges to the damages suffered by class members, who are indirect purchasers, I multiplied the direct purchaser dollar overcharges by the pass-through rate, which is discussed in Section X. I used a pass-through rate of 100%, which provides a conservative estimate of total damages to class members since pass-through estimates are 100% or more. The total damages estimate is \$3.076 billion. See Exhibit 81.

Appendix 1: The basic economics of cartels

This discussion was previously submitted as Section V in my class certification report. It is reproduced (with some very slight editing) here for convenience.

A. Cartel "success" harms its customers

A cartel is a group of firms that explicitly coordinates its pricing or output activities. The objective of a cartel is to increase cartel members' prices and profits above the level that would prevail in the absence of the cartel.³⁵⁹ Accordingly, I consider a cartel to be "successful" or "effective" if its members are able to charge prices above those that would have prevailed absent

³⁵⁶ See Section II.A.

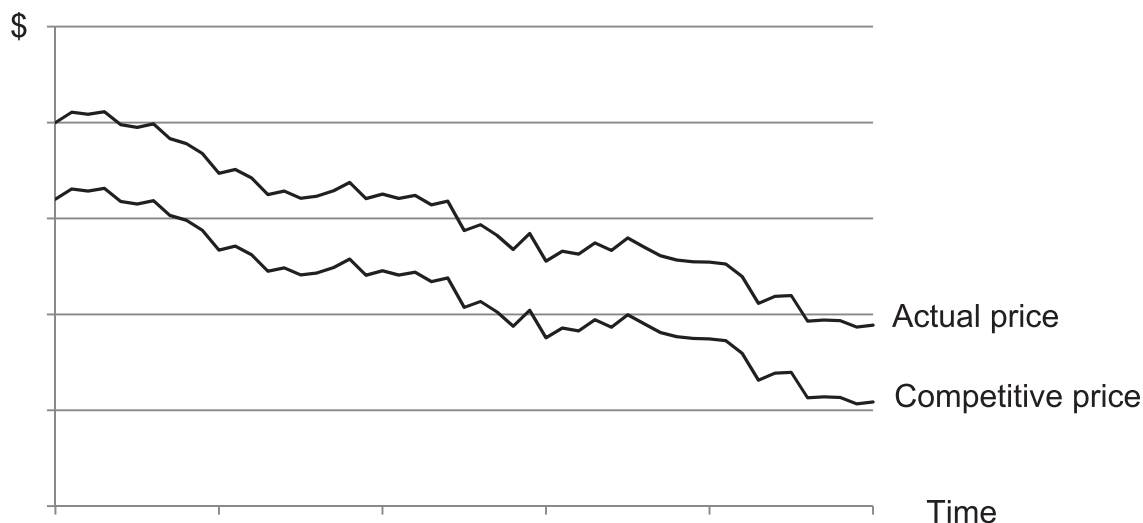
³⁵⁷ Census Bureau, Undated, 1990 to 1999 State Population Estimates, <http://www.census.gov/popest/archives/1990s/ST-99-03.txt>, accessed 22 May 2009 and Census Bureau, December 2009, Population, population change and estimated components of population change: April 1, 2000 to July 1, 2009 (NST-EST2009-alldata), http://www.census.gov/popest/national/files/NST_EST2009_ALLDATA.csv, accessed 19 May 2011.

³⁵⁸ Revenue-weighted average across all products and years.

³⁵⁹ "In any market, firms have an incentive to coordinate their production and pricing activities to increase their collective and individual profits by restricting market output and raising the market price. An association of firms that explicitly coordinates its pricing or output activities is called a cartel." Carlton, Dennis and Jeffery M. Perloff, 2005, *Modern Industrial Organization*, Fourth Edition, Addison-Wesley Longman, Inc., at 122.

the cartel. I call the price that would have prevailed absent the cartel the “competitive price”³⁶⁰ or the “but-for price”. A “successful” cartel, as I use the term, necessarily causes antitrust harm.

Causing price to be above the competitive level is often referred to as “raising” price; this terminology can be confusing, especially when observed prices decline over time. The chart below illustrates hypothetical supra-competitive prices that decline over time:



The line in the chart above labeled “actual price” shows the prices that were actually charged by the cartel; they decline over time.³⁶¹ The line labeled “competitive price” shows the prices that would have prevailed absent the cartel. The cartel overcharge is the amount by which the actual price is above the competitive price. When I refer to the cartel “raising price”, I mean that the price charged by cartel members is above the competitive price; equivalently, that the cartel imposed an overcharge. As the chart above illustrates, “raising the price above the competitive level” can occur when prices are falling over time: the price “rises” relative to the competitive price, it does not necessarily rise over time.

Similarly, “raising price” does not necessarily result in above-normal profit. In certain circumstances, an industry may be subject to below-normal profitability.³⁶² In such cases, a cartel may eke out merely normal (or even below-normal) profit. Such a cartel is nonetheless successful if it charges a higher price than would exist absent the cartel: making a dollar of profit

³⁶⁰ The “competitive price” is not to be confused with the equilibrium price in a perfectly competitive market. Most markets are not perfectly competitive even if free of monopolizing conduct such as cartelization; the “competitive price” is therefore not, in general, equal to the equilibrium price in a perfectly competitive market.

³⁶¹ The cause of the decline in prices is assumed for the purpose of this discussion to be unrelated to the conduct of the cartel. For the purpose at hand, the reason for the decline is immaterial to the point under discussion. In the actual world, prices may decline over time for many reasons unrelated to cartel conduct; for example, prices may decline over time if costs decline over time.

³⁶² Profit is “normal” if firms earn a rate of return equal to their cost of capital. Long-term sub-normal profitability can occur if industry capacity is substantially in excess of current and probable future demands, and rigidities retard the reallocation of capital to more profitable uses. In Section VI.C.2, I show that these conditions prevailed in the CRT industry during the proposed class period.